KEY

TO

WALKINGAME'S

TUTOR'S ASSISTANT.

CONTAINING THE

SOLUTIONS OF THE QUESTIONS,

WITH THE

REFERENCES,

AS THEY STAND IN THE LAST EDITION OF THAT WORK.

TO WHICH IS ADDED,

AN APPENDIX,

ON CIRCULATING DECIMALS,

AND SOME

SHORT AND USEFUL RULES FOR CASTING UP THE VALUE OF ANY SORT OF GOODS, &c.

NECESSARY FOR ALL PERSONS IN TRADE.

The Work is designed for the Ease of Schoolmasters; and, with the Tutor's Assistant, is recommended as the best Compendium hitherto published, for the use of Schools or for private Persons.

2037

BY T. HEWITT.

A NEW EDITION, WITH CORRECTIONS AND ADDITIONS.

LONDON:

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1816.

2037

ADVERTISEMENT.

The very great demand for Walkingame's Arithmetic *is a proof of its merit; and, as the last edition is thoroughly corrected by an experienced arithmetician, the proprietors have now printed this* Key, *which they trust will be generally used in the Seminaries of Learning throughout the kingdom, and trust it will be found an useful and acceptable supplement to the very meritorious and popular work it is intended to illustrate.*

With the assistance of the present undertaking, it is presumed, that such persons as cannot have the instructions of an experienced teacher, will be able to improve themselves; the diffident master of a juvenile academy will have a certain criterion on which he may depend; and the more practised and perfect arithmetician will avoid the labour, and consequent loss of time, in working the sum of each of his scholars.

Every sum therein has been worked anew, and the whole thought to be completely accurate.

Such persons as wish to honour the Proprietors with their patronage, are requested to be particular in giving orders for the genuine edition of

WALKINGAME's ARITHMETIC,

which is signed James Scatcherd, *on the back of the title-page; or*

THE KEY, by *T. HEWITT.*

EXPLANATION

OF

THE CHARACTERS

MADE USE OF IN THIS KEY.

= *Equal.*	The sign of Equality; as 4*qrs.* = 1 *cwt.* signifies, that 4*qrs.* are equal to 1*cwt.*
− *Minus, or Less.*	The sign of Subtraction; as $8-2=6$; that is, 8 lessened by 2 is equal to 6.
+ *Plus, or More.*	The sign of Addition; as $4+4=8$; that is, 4 added to 4 more, is equal to 8.
× *Multiplied by.*	The sign of Multiplication; as $4\times 6=24$: that is, 4 multiplied by 6, is equal to 24.
÷ *Divided by.*	The sign of Division; as $10\div 2=5$; that is, 10 divided by 2, is equal to 5.
2362 57	Numbers placed like a fraction, do likewise denote Division; the upper number being the Dividend, and the lower the Divisor.
: : *So is.*	The sign of Proportion; as 2 : 4 : : 8 : 16; that is, as 2 is to 4, so is 8 to 16.
$\overline{8-3}+5=10$.	Shows that the Difference between 3 and 8, added to 5, is equal to 10.
$9-\overline{3+4}=2$.	Signifies, that the sum of 3 and 4, taken from 9, is equal to 2.
$\sqrt{9}=3$.	Prefixed to any number signifies the Square Root of that number, or Square Root of 9 is 3.
$\sqrt[3]{8}=2$.	Signifies, the Cube Root of 8 is 2.
$\sqrt[4]{16}=2$.	Signifies, the Biquadrate or Fourth Root of 16 is 2.

MAHARAJA SERFOGI'S SARASWATI MAHAL

KEY

TO

WALKINGAME'S

TUTOR's ASSISTANT.

PART I.

NUMERATION.

WORDS EXPRESSED IN FIGURES.

(1)	(2)	(3)	(4)	(5)	(6)
23	254	3204	25856	(132245)	4941400

(7)	(8)	(9)
27157832	722231504	602210500.

NUMBERS EXPRESSED IN WORDS.

(1) Thirty-five.
(2) Fifty-nine.
(3) One hundred and seventy-two.
(4) Two thousand and seventeen.
(5) Five thousand two hundred and one.
(6) Twenty thousand seven hundred and sixty-six.
(7) Five hundred nineteen thousand and seven.
(8) Seven hundred fifty-four thousand and fifty-eight.
(9) Five million nine hundred thousand and thirty.
(10) Five million two hundred seven thousand and fifty-four.

(11) Two million seventy-one thousand nine hundred and nine

(12) Seventy million fifty-four thousand and eight.

(13) Sixty-five million seven hundred thousand and forty-seven.

(14) Nine hundred million sixty-one thousand and fifty-seven.

(15) One hundred twenty-one million nine hundred thousand seven hundred and ninety.

ADDITION OF INTEGERS.

HERE, in the first example, begin at the unit's column, say, 2 and 1 are 3, and 4 are 7, and 3 are 10, and 5 are 15; set down the units 5, and carry the 1 for one ten, to the 5 in the ten's column, and say 1 and 5 are 6, and 7 are 13, and 5 are 18, and 7 are 25, and 1 are 26, and 7 are 33; set down 3 and carry 3 to the 3 in the hundred's column, and say 3 and 3 are 6, and 2 are 8, and 3 are 11, and 4 are 15, and 1 are 16, and 2 are 18; as there are no more columns, set them down accordingly, and so the whole sum is 1835 qrs. The very same method must be observed in the other examples.

(1) 1835 (2) 21633 (3) 305100 (4) 2363539
(5) 17206 (6) 730,828 (7) 1528 (8) 365.

SUBTRACTION OF INTEGERS.

IN the first example we say, 4 from 1 we cannot take, but borrowing 10 it becomes 11, from which take 4, the remainder is 7, which put down, and carry 1 to the 5, it becomes 6, which take from 7, there remains 1, which put down; again take 1 from 2, there rests 1, which set down, and the whole remainder is 117, and so for any other.

(1) 117. (2) 2029. (3) 7991. (4) 125089.
(5) 119037. (6) 599341.

MULTIPLICATION OF INTEGERS.

CASE I.

(1) 50209472 (2) 157413063 (3) 31701750084
(4) 13552035 (5) 1386282 (6) 49647612
(7) 29800832 (8) 37939194 (9) 27010570
(10) 341441881 (11) 8386248

CASE II.

(12) 17131776
5710592·
74237696

(13) 20429008
5107252·
71501528

(14) 38266050
7653210·
114798150

(15) 1472914640 (16) 106279257 (17) 165875832

(18) 48855479 (19) 71842080

CASE III.

1395048392437 (21) 100194555576

(22) 1268093791716 (23) 587911496729018

(24) 7911929080092072652.

CASE IV.

(25) 15427848836 (26) 431005821005650.

CASE V.

(27) 232016332388020 (28) 4690300000

(29) 382454600000 (30) 72966075000000

CASE VI.

(31) 26986365 (32) 29490016 (33) 4005349(

(34) 1149833664.

DIVISION OF INTEGERS.

CASE I.

Quot. Rem.		
(1) 362553.1	(2) 2403490.2	(3) 1802604
(4) 1440657.2	(5) 871839.3	(6) 361814.:
(7) 318415.5	(8) 2783034	(9)

In the first example we say, the two's in 7 are 3 time and 1 over, which put to the 2 makes 12, the two's in 1 are 6 times, and the two's in 5 are 2 and 1 remains, an the two's in 11 are 5 and 1 remains, and the two's in 1 are 5 and nothing remains, the two's in 7 are 3 and 1 re mains, which place at the end of the quotient, with a das between, the whole quotient is 362553-1. The other ex- amples are done in the same manner.

CASE II.

```
    Div. Divid.    Quot.
(9) 29)4172377(143875
        29.....
        ---
        127
        116
        ---
         112
          87
         ---
          253
          232
          ---
           217
           203
           ---
            147
            145
            ---
      Rem.    2
```

```
     Div. Divid.    Quot.
(10) 37)7210473)194877
         37.....
         ---
         351
         333
         ---
          180
          148
          ---
           324
           296
           ---
            287
            259
            ---
             283
             259
             ---
      Rem.    24
```

```
     Div.  Divid.     Quot.
(11) 347)42749467(123197
         347.....
         ---
         804
         694
         ---
          1109
          1041
          ----
            684
            347
           ----
           3376
           3123
           ----
            2537
            2429
            ----
      Rem.   108
```

```
     Div.   Divid.      Quot.
(12) 5743)734097143(127824
          5743.....
          ----
          15979
          11486
          -----
           44937
           40201
           -----
            47361
            45944
            -----
             14174
             11486
             -----
              26883
              22972
              -----
      Rem.     3911
```

```
          Div.       Divid.       Quot.
(13)  54716)1610478407(29433
            109432....
            ------
            516158
            492444
            ------
             237144
             218864
             ------
              182800
              164148
              ------
               186527
               164148
               ------
        Rem.    22379
               ======

          Div.       Divid.        Quot.
(14)  510834)4973401891(9735
             4597506...
             -------
             3758958
             3575838
             -------
              1831209
              1532502
              -------
               2987071
               2554170
               -------
        Rem.    432901
               =======

          Div.        Divid.        Quot.
(15)  4765043)51704567874(10850
              4765043....
              -------
              40541378
              38120344
              --------
               24210347
               23825215
               --------
        Rem.    3851324
               ========
```

```
       Div.             Divid.              Quot.
(16) 31479461)174537989461237 41(554450374
              157397305 ........
              ---------
              171406844
              157397305
              ---------
               140095396
               125917844
               ---------
                141775521
                125917844
                ---------
                 158576772
                 157397305
                 ---------
                  117946737
                   94438383
                  ---------
                   235083544
                   220356227
                   ---------
                    147273171
                    125917844
                    ---------
              Rem.   21355327
                    =========
```

CASE III.

```
       Div.     Divid.    Quot.
(17) 271|00)254732|21(939
             2439 ..
             ----
              1083
               813
              ----
               2702
               2439
               ----
         Rem. 26321
              =====
```

```
     Div.       Divid.      Quot.
(18) 273|000)752473|729(2756
             546 ...
             ----
             2064
             1911
             -----
              1537
              1365
              ----
               1723
               1638
               -----
    Rem.       85729
               =====

     Div.        Divid.      Quot.
(19) 5721|00)7253472|16(1267
             5721 ...
             -----
             15324
             11442
             -----
              38827
              34326
              -----
               45012
               40047
               ------
    Rem.       496516
               ======

     Div.       Divid.         Quot.
(20) 215|000)6325104|997(29419
             430....
             ----
             2025
             1935
             ----
               901
               860
               ---
                410
                215
                ----
                1954
                1935
                -----
    Rem.        19997
                =====
```

CASE IV.

(21) 3)3210473

9)1070157-2

3 × 9 = 27. 118906-11

(22) 7)7210473

5)1030067-4

5 × 7 = 35. 206013-18

(23) 6)6251043

7)1041840-3

6 × 7 = 42. 148834-15

(24) 6)5761034

9)960172-2

6 × 9 = 54. 106685-44

ADDITION OF MONEY, WEIGHTS, AND MEASURES.

MONEY.

	£.	s.	d.		£.	s.	d.		£.	s.	d.
(1)	39	6	$7\frac{1}{4}$	(2)	385	9	$1\frac{1}{4}$	(3)	388	14	$0\frac{1}{2}$
(4)	379	9	5	(5)	2745	6	$11\frac{1}{2}$	(6)	2563	3	$10\frac{1}{2}$
(7)	315	5	$8\frac{3}{4}$	(8)	424	11	$1\frac{1}{2}$	(9)	2042	7	$6\frac{3}{4}$
(10)	2168	9	$3\frac{1}{4}$	(11)	306	0	$8\frac{1}{4}$	(12)	164	0	$3\frac{1}{2}$

HERE, in the first example, we begin and cast up the column of farthings, and the sum is 9 farthings, set down a farthing and carry two pence to the row of pence, the amount of which is 31*d.* set down 7*d.* and carry 2*s.* to the row of shillings, the amount of which is 86*s.* or £4. 6*s.* set down 6*s.* and carry £4. which add up as in simple addition, and the whole sum is £39. 6*s.* $7\frac{1}{4}$*d.* the rest are done the same.

TROY WEIGHT.

	oz.	dwt.	gr.		lb.	oz.	dwt.		lb.	oz.	dwt.	gr.
(1)	43	18	16	(2)	29	11	14	(3)	31	0	6	20

AVOIRDUPOISE WEIGHT.

	lb.	*oz.*	*dr.*		*cwt.*	*qr.*	*lb.*		*tons.*	*cwt.*	*qr.*	*lb.*
(1)	1784	12	7	(2)	249	3	26	(3)	35	1	3	22.

APOTHECARIES' WEIGHT.

	℔	℥	ʒ	℈		℔	℥	ʒ	℈	*gr.*
(1)	151	8	6	2	(2)	38	7	5	0	9.

CLOTH MEASURE.

	Fl.ells.	*qr.*	*nls.*		*yds.*	*qr.*	*nls.*		*E.ells.*	*qr.*	*nls.*
(1)	1007	1	1	(2)	784	1	2	(3)	894	1	2.

LONG MEASURE.

	yds.	*f.*	*in.*	*b.c.*		*lea.*	*m.*	*fur.*	*p.*		*acres*	*ro.*	*per.*
(1)	1139	0	3	0	(2)	339	1	1	2	(3)	4476	3	17.

LAND MEASURE.

	acres	*ro.*	*per.*		*acres*	*ro.*	*per.*
1)	4476	3	17	(2)	3370	0	3.

WINE MEASURE.

	hhds.	*gal.*	*qts.*		*tuns.*	*hhds.*	*gal.*	*qt.*
(1)	404	2	2	(2)	279	2	25	1.

ALE AND BEER MEASURE.

	a.b.	*fir.*	*gal.*		*b.b.*	*fir.*	*gal.*		*hhds.*	*gal.*	*qts.*
(1)	387	3	2	(2)	351	2	4	(3)	341	51	0.

DRY MEASURE.

	ch.	*bu.*	*pk.*		*lasts*	*wey*	*qr.*	*bu.*	*pks.*
(1)	413	27	1	(2)	303	1	0	5	3.

TIME.

	wks.	*da.*	*ho.*		*wks.*	*da.*	*ho.*	*mi.*	*sec.*
(1)	373	5	5	(2)	380	5	21	18	5.

THE APPLICATION TO THE FOREGOING.

				£.	s.	d.
(1)	1750	(2)	A laid out....	7	15	6
	47		B............	2	9	0
			C............	2	14	6
Ans.	1797		D............	0	7	3
			Ans.	13	6	3

(3)

	£.	s.	d.
Lent at different times....	63	0	0
	25	15	0
	32	7	0
	15	14	10
	99	11	6
Ans.	236	8	4

	£.	s.	d.
(4) 21 guineas is............	22	1	0
8 score and £19. 14*s*. is	179	14	0
Ans.	201	15	0

(5) First Num.	215
Second....	519
Third	734
Ans.	1468

	£.	s.	d.
(6) Paid for goods	54	17	0
packing	0	13	8
carriage	1	5	4
spent	0	14	3
Ans.	57	10	3

(7)

Least Number............	40
Their difference	14
Greater Number..........	54 } *Ans.*
Sum....................	94 } *Ans.*

(8)

	£.
Eleven thousand, &c. is....	12111
Add....................	1500
Eldest sister's fortune......	13611
Youngest................	12111
Father left them	25722 *Ans.*

	£.	s.	d.
(9) Owed rent	86	2	0
Wine-Merchant	72	5	0
Confectioner	12	13	4
Draper	47	13	2
Taylor	110	15	6
Coachmaker	157	8	0
Tallowchandler	8	17	9
Cornchandler	170	6	8
Brewer	52	17	0
Butcher	122	11	5
Baker	37	9	5
Wages	53	18	0
Add	100	0	0
Ans.	1032	17	3

	yrs.	mo.	da.
(10) The father's age when his first child was born	24	0	0
Number of years between each of their births respectively	1	11	14
	2	1	15
	2	10	25
The age of the fourth	27	9	12
The father's age, the *Ans.*	58	7	10

	£.	s.	d.
(11) Received of A	7	5	2
———— B	15	18	$6\frac{1}{2}$
———— C	150	13	$2\frac{1}{4}$
———— D	17	6	8
———— E	6	9	2
———— F	0	6	8
———— G	76	15	$9\frac{1}{2}$
———— H	121	12	4
He had to pay	396	7	$6\frac{1}{4}$ *Ans*

(12)	oz.	dwts.
Service plate......	203	8
Plate..............	408	9
Spoons............	112	8
Salts, &c..........	71	7
Knives, &c.......	73	5
Cups, &c.........	121	4
Tea-kettle, &c....	131	7
Small articles	105	5
	12)1226	13
Ans.	102*lb.* 2*oz.*	13*dwt.*

(13)	cwt.	qr.	lb.
	2	3	13
	2	2	11
	2	3	5
	2	3	12
	2	3	15
84+84 / 28 =	1	2	0
Ans.	15	2	0

(14) A owes to B for goods at different times.....

£.	s.	d.
103	12	2
93	3	4
121	17	0
142	15	4
171	15	10
142	12	6
205	7	2
Ans. 981	3	4

SUBTRACTION OF MONEY, WEIGHTS, AND MEASURES.

MONEY.

	£.	s.	d.		£.	s.	d.		£.	s.	d.
(1)	238	18	$10\frac{3}{4}$	(2)	98	1	$3\frac{3}{4}$	(3)	7	19	$2\frac{1}{2}$
(4)	2	0	$6\frac{1}{2}$	(5)	7	12	$8\frac{3}{4}$	(6)	11	18	2
(7)	64	2	$6\frac{1}{2}$	(8)	22	18	$1\frac{1}{4}$	(9)	51	8	$8\frac{1}{4}$
(10)	387	17	$9\frac{3}{4}$	(11)	Paid in all				2218	7	$8\frac{3}{4}$
					Remains to pay				22889	7	$10\frac{1}{4}$

	£.	s.	d.
(12) Received in all....	2057	14	$4\frac{3}{4}$
Remains due......	23098	7	$1\frac{1}{4}$

TROY WEIGHT.

	lb.	oz.	dwt.	gr.		lb.	oz.	dwt.	gr.
(1)	13	0	11	19	(2)	1	7	1	4.

AVOIRDUPOISE WEIGHT.

	lb.	oz.	dr.		cwt.	qr.	lb.		ton	cwt.	qr.	lb.
(1)	5	13	14	(2)	10	0	11	(3)	11	19	3	2.

APOTHECARIES' WEIGHT.

	℔	℥	ʒ	℈		℔	℥	ʒ	℈	gr.
(1)	2	8	6	2	(2)	3	11	6	2	15.

CLOTH MEASURE.

	Fl. e.	qr.	n.		yds.	qr.	n.		E. e.	qr.	n.
(1)	18	0	1	(2)	67	3	1	(3)	20	3	3.

LONG MEASURE.

	yds.	ft.	in.	bar.		lea.	mi.	fu.	po.
(1)	28	2	10	2	(2)	88	2	6	36.

LAND MEASURE.

	ac.	r.	p.		ac.	r.	p.
(1)	116	1	0	(2)	45	2	36.

WINE MEASURE.

	hhd.	gal.	qt.	pi.		tuns	hhd.	gal.	qts.
(1)	18	50	3	1	(2)	24	2	50	3.

ALE AND BEER MEASURE.

	a.b.	fir.	gal.		b.b.	fir.	gal.		hhd.	gal.	qts.
(1)	3	3	5	(2)	12	0	3	(3)	14	30	3.

DRY MEASURE.

	qu.	bu.	p.		qu.	bu.	p.		ch.	bu.	p.
(1)	36	6	3	(2)	7	7	2	(3)	24	31	3.

TIME.

	yrs.	mo.	we.	da.		ho.	min.	sec.
(1)	55	11	2	6	(2)	14	48	58.

THE APPLICATION TO THE FOREGOING.

(1) From 1781
Take 1723

Ans. 58 years.

(2) From 1766
Take 1710

Ans. 56 years.

(3) £.
From 1156
Take 737

Ans. £.419

		£.	s.
(4)	From	300	0
	Take	254	6
	Ans.	45	14

(5) £.
9154
754+305=1059

Ans. 8095

		£.	s.	d.
(6)	From	37	5	0
	Take horse	14	14	0
	From	22	11	0
	Take	14	14	0
	Ans.	7	17	0

		£.	s.	d.	
(7)	Cash in hand........	12510	7	0	
	Cleared the first year	452	3	6	
	Sum	12962	10	6	
	Owed	750	0	0	
	Neat balance	12212	10	6	*Ans.*

(8) £.
45247 whole sum left.
16530=15 thousand 15 hundred, &c.

£.28717 *Ans.*

(9)

	£.	s.	d.
Stock......	212	6	0
Book-debts	112	8	3
Cash in hand	21	10	5
His whole effects	346	4	8

	£.	s.	d.
A owed	53	7	6
B ——	105	10	0
C ——	34	5	2
D ——	28	16	5
E ——	14	15	8
F ——	112	9	0
G ——	143	12	9
What he owed	492	16	6
	346	4	8
His creditors lost	146	11	10 *Ans.*

(10)

	£.	s.	d.
Sent bees-wax to the value of	37	15	4
Stocking..............	37	6	7
Tobacco..............	125	11	6
Linen cloth...........	112	14	8
Tin.................	115	10	5
Total value	428	18	6

	£.	s.	d.
Value in wines...........	250	15	0
Fruit..................	51	12	6
Figs..................	19	17	6
Oil....................	19	12	4
Spanish wool...........	115	15	6
Total value	457	12	10
Deduct	428	18	6
Ans. Due to my Spanish correspondent	28	14	4

MULTIPLICATION OF SEVERAL DENOMINATIONS.

	£.	s.	d.		£.	s.	d.	
(1)	35	12	$7\frac{1}{4}$	$\times 2 =$	71	5	$2\frac{1}{2}$	*Ans.*
(2)	75	13	$1\frac{1}{2}$	$\times 3 =$	226	19	$4\frac{1}{2}$	*Ans.*
(3)	62	5	$4\frac{1}{4}$	$\times 4 =$	249	1	5	*Ans.*
(4)	57	2	$4\frac{3}{4}$	$\times 5 =$	285	11	$11\frac{3}{4}$	*Ans.*

THE PRACTICAL QUESTIONS.

(1)

	£.	s.	d.
	0	9	6
$3 \times 6 = 18$			
	1	8	6
			6
Ans.	8	11	0

(2)

	£.	s.	d.
	1	2	6
$5 \times 5 + 1 = 26$			
	5	12	6
			5
	28	2	6
	1	2	6
Ans.	29	5	0

(3)

	£.	s.	d.
	0	7	$8\frac{1}{2}$
$3 \times 7 = 21$			
	1	3	$1\frac{1}{2}$
			7
Ans.	8	1	$10\frac{1}{2}$

(4)

	£.	s.	d.
	0	15	$3\frac{1}{2}$
$5 \times 7 = 35$			
	3	16	$5\frac{1}{2}$
			7
Ans.	26	15	$2\frac{1}{2}$

	£.	s.	d.	
(5)	0	7	$2\frac{3}{4}$	
				$6\times12+3=75$
	2	3	$4\frac{1}{2}$	
			12	
	26	0	6	
	1	1	$8\frac{1}{4}$	
	27	2	$2\frac{1}{4}$	*Ans.*

	£.	s.	d.	
(6)	0	9	7	
				$6\times6+1=37$
	2	17	6	
			6	
	17	5	0	
	0	9	7	
	17	14	7	*Ans.*

	£.	s.	d.	
(7)	1	5	3	
				$8\times12+1=97$
	10	2	0	
			12	
	121	4	0	
	1	5	3	
	122	9	3	*Ans.*

	£.	s.	d.	
(8)	0	6	4	
				$6\times7+1=43$
	1	18	0	
			7	
	13	6	0	
	0	6	4	
	13	12	4	*Ans.*

	£.	s.	d.	
(9)	0	12	3	
				$11\times11+6=127$
	6	14	9	
			11	
	74	2	3	
	3	13	6	
	77	15	9	*Ans.*

	£.	s.	d.	
(10)	0	7	5	
				$11\times12+3=135$
	4	1	7	
			12	
	48	19	0	
	1	2	3	
	50	1	3	*Ans.*

	£.	s.	d.	
(11)	0	1	$4\frac{1}{2}$	
				$9\times8+2=74$
	0	12	$4\frac{1}{2}$	
			8	
	4	19	0	
	0	2	9	
	5	1	9	*Ans.*

	£.	s.	d.	
(12)	0	1	10	
				$6\times12=72$
	0	11	0	
			12	
	6	12	0	*Ans.*

	£.	s.	d.	
(13)	0	3	$4\frac{1}{2}$	
				$5 \times 5 + \frac{1}{2} = 25\frac{1}{2}$
	0	16	$10\frac{1}{2}$	
			5	
	4	4	$4\frac{1}{2}$	
	0	1	$8\frac{1}{4}$	$= \frac{1}{2}$ top line
	4	6	$0\frac{3}{4}$	*Ans.*

	£.	s.	d.	
(14)	0	1	3	
				$6 \times 12 + 3\frac{1}{2} = 75\frac{1}{2}$
	0	7	6	
			12	
	4	10	0	
	0	3	9	
	0	0	$7\frac{1}{2}$	$= \frac{1}{2}$ top line
	4	14	$4\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(15)	0	4	3	
				$6 \times 3 + 1\frac{1}{2} = 19\frac{1}{2}$
	1	5	6	
			3	
	3	16	6	
	0	4	3	
	0	2	$1\frac{1}{2}$	$= \frac{1}{2}$ top line
	4	2	$10\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(16)	0	1	4	
				$7 \times 5 + \frac{1}{2} = 35\frac{1}{2}$
	0	9	4	
			5	
	2	6	8	
	0	0	8	$= \frac{1}{2}$ top line
	2	7	4	*Ans.*

	£.	s.	d.	
(17)	1	1	6	
			$7\frac{1}{4}$	
	7	10	6	
	0	5	$4\frac{1}{2}$	$= \frac{1}{4}$ top line
	7	15	$10\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(18)	3	15	7	
			$6\frac{1}{2}$	
	22	13	6	
	1	17	$9\frac{1}{2}$	$= \frac{1}{2}$ top
	24	11	$3\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(19)	4	15	6	
				$7 \times 5 + \frac{1}{2} = 35\frac{1}{2}$
	33	8	6	
			5	
	167	2	6	
	2	7	9	$= \frac{1}{2}$
	169	10	3	*Ans.*

	£.	s.	d.	
(20)	4	17	10	
				$12 \times 12 + 10\frac{1}{2} = 154\frac{1}{2}$
	58	14	0	
			12	
	704	8	0	
	48	18	4	= 10 times top line
	2	8	11	$= \frac{1}{2}$ ditto
	755	15	3	*Ans.*

	£.	s.	d.	
(21)	0	12	6	$11 \times 10 + 7\frac{1}{4} = 117\frac{1}{4}$
	6	17	6	
			10	
	68	15	0	
	4	7	6	= 7 times top line
	0	3	$1\frac{1}{2}$	= $\frac{1}{4}$ of ditto
	73	5	$7\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(22)	1	7	8	$7 \times 12 + 1\frac{3}{4} = 85\frac{3}{4}$
	9	13	8	
			12	
	116	4	0	
	1	7	8	= once top line
	1	0	9	= $\frac{3}{4}$ of ditto
	118	12	5	*Ans.*

	£.	s.	d.	
(23)	1	3	6	$7 \times 4 + 1\frac{1}{4} = 29\frac{1}{4}$
	8	4	6	
			4	
	32	18	0	
	1	3	6	= once top line
	0	5	$10\frac{1}{2}$	= $\frac{1}{4}$ of ditto
	34	7	$4\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(24)	1	3	6	$4 \times 4 + 1\frac{3}{4} = 17\frac{3}{4}$
	4	14	0	
			4	
	18	16	0	
	1	3	6	= once top line
	0	17	$7\frac{1}{2}$	= $\frac{3}{4}$ of ditto
	20	17	$1\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(25)	0	12	4	$6 \times 6 + 1\frac{1}{2} = 37\frac{1}{2}$
	3	14	0	
			6	
	22	4	0	
	0	12	4	
	0	6	2	
	23	2	6	*Ans.*

	£.	s.	d.	
(26)	2	18	7	$8 \times 7 + \frac{3}{4} = 56\frac{3}{4}$
	23	8	8	
			7	
	164	0	8	
	2	3	$11\frac{1}{4}$	= $\frac{3}{4}$ top line
	166	4	$7\frac{1}{4}$	*Ans.*

	£.	s.	d.	
(27)	2	15	6	
				$8\times 12+\frac{1}{2}=96\frac{1}{2}$
	22	4	0	
			12	
	266	8	0	
	1	7	9	= top line
	267	15	9	*Ans.*

	£.	s.	d.	
(28)	0	18	6	
				$5\times 9+\frac{3}{4}=45\frac{3}{4}$
	4	12	6	
			9	
	41	12	6	
	0	13	$10\frac{1}{2}$	$=\frac{3}{4}$ top line
	42	6	$4\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(29)	0	4	3	
				$7\times 12+3\frac{3}{4}=87\frac{3}{4}$
	1	9	9	
			12	
	17	17	0	
	0	12	9	= 3 times top line
		3	$2\frac{1}{4}$	$=\frac{3}{4}$ of ditto
	18	12	$11\frac{1}{4}$	*Ans.*

	£.	s.	d.	
(30)	4	7	6	
				$12\times 10+\frac{3}{4}=120\frac{3}{4}$
	52	10	0	
			10	
	525	0	0	
	3	5	$7\frac{1}{2}$	$=\frac{3}{4}$ top line
	528	5	$7\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(31)		3	$9\frac{1}{2}$	
				$10\times 10\times 4+7=407$
	1	17	11	
			10	
	18	19	2	
			4	
	75	16	8	
	1	6	$6\frac{1}{2}$	= 7 times top line
	77	3	$2\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(32)	0	7	$7\frac{1}{4}$	
				$10\times 10\times 7+20+9=729$
	3	16	$0\frac{1}{2}$	
			10	
	38	0	5	
			7	
	266	2	11	
	7	12	1	= twice tens' line
	3	8	$5\frac{1}{4}$	= 9 times top line
	277	3	$5\frac{1}{4}$	*Ans.*

```
      £.  s.  d.
(33)  0   9   5½
          10×10×10×2+68=2068
      ----------
      4  14   7
             10
      ----------
     47   5  10
             10
      ----------
    472  18   4
              2
      ----------
    945  16   8
     28   7   6=6 times tens' line
      3  15   8=8 times top line
      ----------
    977  19  10 Ans.
```

THE APPLICATION TO THE FOREGOING.

```
     £.  s.  d.                    £.  s.  d.
(1)  14   6  8½               (2)  125  15  6
             6×3=18                      5×5×10=250
     ----------                    ----------
     86   0  3                     628  17  6
             3                               5
     ----------                    ----------
    258   0  9 Ans.               3144   7  6
                                            10
                                   ----------
                                 31443  15  0 Ans.
```

(3) 12×12×6=864=6 dozen dozen.
6×12= 72=half dozen dozen.

difference=792
sum=936

864×72=62208=their product.

(4) $58 \times 2 = 116$ = twice fifty-eight
$\overline{8 \times 2} + 50 = 66$ = twice eight and fifty.
50 = difference.
$116 \times 66 = 7656$ = their product.

(5) $37 \times 45 = 1665$ greater.
76
$19 \times 4 = 76$ difference. 1589 less.
$1665 + 1589 = 3254$ sum.
$1665 \times 1589 = 2645685$ product. } *Ans.*

(6) 360 sum.
144 less number.
216 greater.
72 difference.
$216 \times 144 = 31104$ product.
$72 \times 72 = 5184$ square of difference.

(7) $187 \times 157 = 29359$ number of horse.
207 $560 = 115920$ number of foot.
145279
473 sick.
Ans. 144806 effective men.

	£.	s.	d.	
(8)	22	1	0	= 21 guineas.
			7	$= 87 \times 2 = 7 \times 12 + 3 \times 2$.
	154	7	0	
			12	
	1852	4	0	
	66	3	0	
	1918	7	0	half the value.
			2	
Ans.	3836	14	0	whole value.

(9)

	£.	s.	d.	
He had to begin with	19118	0	0	
£.1086 × 5 =	5430	0	0	cleared the first 5 yrs.
£2715. 10*s*. 6*d*. × 4 =	10862	2	0	ditto the next 4 years.
	35410	2	0	his fortune at 9 years end.
£.475 4*s*. 6*d*. × 3 =	1425	13	0	his loss in 3 years.
Ans.	33984	8	6	his real fortune at 12 years end.

(10)

cwt. *qrs.* *lb.*	*cwt.*	*qrs.*	*lb.*	
137 2 10 × 4 =	550	1	12	= weight of 12 draughts.
13 1 0 × 12 =	159	0	0	= weight of the waggon or tare
Ans.	391	1	12	

(11)

£.	s.	d.	
1	12	6	
			12 × 10 × 3 + 5
19	10	0	
		10	
195	0	0	
		3	
585	0	0	
8	2	6	= five times the top line.
593	2	6	
294	12	6	add.
887	15	0	*Ans.*

(12)

£.
50
2 = four crowns, 8 half ditto.

52
72 = 12 × 6

Ans. 3744

(13)

	£.	s.	d.
A quarter's rent	8	10	6
repairs	0	15	0
	7	15	6
			4
yearly cost	31	2	0
			7
Ans.	217	14	0

(14)

	£.	s.	d.		£.	s.	d.
First	37	14	2	×4=	150	16	8
	31	4	2	×4=	124	16	8
	18	12	6	×4=	74	10	0
					350	3	4

	£.	s.	d.	
From	386	15	6	
take	350	3	4	
deficiency	36	12	2	*Ans.*

(15)

	£.	s.	d.	
What the gentleman left to his widow	4560	0	0	
To a charity......................	572	10	0	
To his nephews £750. 10*s.* 0*d.* × 4=	3002	0	0	
To his nieces £375. 12*s.* 6*d.* × 4=	1502	10	0	
To the housekeepers £10. 10*s.* × 30=	315	0	0	
To his executor....................	157	10	0	
The sum he left at his death	10109	10	0	*Ans.*

(16) The divisor is=423+20+19=462

423=quotient.

1386
924
1848
20 add

Dividend 195446 *Ans.*

EXAMPLES OF WEIGHTS AND MEASURES.

	lb.	*oz.*	*dwt.*	*gr.*	
(1)	9	10	15	19	
				9	
	89	1	2	3	*Ans.*

	tons.	*cwt.*	*qr.*	*lb.*	
(2)	23	19	3	18	
				7	
	167	19	1	14	*Ans.*

	yds.	*qrs.*	*nls.*	
(3)	107	3	2	
			10	
	1078	3	0	*Ans.*

	a.b.	*fir.*	*gal.*	
(4)	33	2	3	
			11	
	369	2	1	*Ans.*

	b.b.	*fir.*	*gal.*	*qts.*	
(5)	27	2	4	3	
				12	
	331	2	3	0	*Ans.*

	miles	*fur.*	*po.*	
(6)	110	6	26	
			12	
	1329	7	32	*Ans.*

DIVISION

OF SEVERAL DENOMINATIONS.

		£.	*s.*	*d.*	
(1)	2)	25	2	4	
		12	11	2	*Ans.*

		£.	*s.*	*d.*	
(2)	3)	37	7	7	
		12	9	$2\frac{1}{4}\frac{1}{3}$	*Ans.*

(3)

	£.	s.	d.	
4)	57	5	7	
	14	6	$4\frac{3}{4}$	*Ans.*

(4)

	£.	s.	d.	
5)	52	7	0	
	10	9	$4\frac{3}{4}\frac{1}{5}$	*Ans.*

(5) £. s. d. £.

243)1407 17 7 (5
1215
192
20
243)3857 (15*s.*
243.
1427
1215
212
12
243)2551 (10*d.*
2430
121
4
243)484 ($\frac{1}{4}$
243
241 *Rem.*

(6) £. s. d. £.

1794)700791 14 4 (390
5382..
16259
16146
1131
20
1794)22634 (12*s.*
1794.
4694
3588
1106
12
1794)13276 (7*d.*
12558
718
4
1794)2872 ($\frac{1}{4}$
1794
1078 *Rem.*

THE TANJORE MAHARAJA SERFOJI'S SARASWATI MAHAL

(7) £. s. d. £.

31715)490981 3 $7\frac{1}{2}$(15
31715.

173831
158575

15256
20

31715)305123 (9*s.*
285435

19688
12

31715)236263 (7*d.*
222005

14258
4

31715)57034 ($\frac{1}{4}$
31715

25319 *Rem.*

(8) £. s. d. £.

214725)19743052 5 $7\frac{1}{2}$(91
1932525.

417802
214725

203077
20

214725)4061545 (18*s.*
214725.

1914295
1717800

196495
12

214725)2357947 (10*d.*
2147250

210697
4

214725)842790 ($\frac{3}{4}$
644175

198615 *Rem.*

THE APPLICATION.

(1) £. s. d.

12)257 2 5

21 8 $6\frac{1}{4}\frac{8}{12}$ *Ans.*

(2) £. s. d.

35 { 7)57 3 7
5) 8 3 $4\frac{1}{4}\frac{5}{7}$

1 12 $8\frac{12}{35}$ *Ans.*

(3)

	£.	s.	d.
9)	37	6	$4\frac{3}{4}$
Ans.	4	2	$11\frac{7}{9}$

(4) 20 {

	£.	s.	d.
4)	27	5	$4\frac{1}{2}$
5)	6	16	$4\frac{1}{8}$
Ans.	1	7	$3\frac{9}{40}$

(5) 120 {

	£.	s.	d.
10)	154	17	10
12)	15	9	$9\frac{2}{5}$
Ans.	1	5	$9\frac{3}{4}\frac{2}{15}$

(6) 72 {

	£.	s.	d.
6)	85	6	0
12)	14	4	4
Ans.	1	3	$8\frac{1}{4}\frac{1}{3}$

(7) $36 \div 2 = 18$)

	£.	s.	d.
18)	275	3	4
$18 = 6 \times 3$ *Ans.*	15	5	$8\frac{3}{4}\frac{5}{9}$

(8) 500 {

	£.	s.	d.
10)	7257	3	6
10)	725	14	$4\frac{1}{5}$
5)	72	11	$5\frac{11}{50}$
Ans.	14	10	$3\frac{1}{4}\frac{7}{125}$

(9) 509)2545(5 bullocks each had.
2545
....

£.	s.	d.	
9	14	6	
		10	
97	5	0	=price of ten bullocks.
		10	
972	10	0	=price of 100 ditto.
		10	
9725	0	0	=price of 1000 ditto.
		2	
19450	0	0	=price of 2000 ditto.
4862	10	0	=price of 500 ditto.
389	0	0	=price of 40 ditto.
48	12	6	=price of 5 ditto.
509)24750	2	6	
Ans. 48	12	6	each man's share.

(10) 35=7×5)9625

```
35=7×5)9625
       ----
       1925
       ----
Ans.    275 yards long.
       ====
```

(11) £.10÷25=£200÷25=8*s*. 0*d*. equal to what each man contributed. £.4000÷25=£.160=each man's share.

(12) £.1156÷17=£.68 *Ans.*

(13) £.2805÷7½=£.5610÷15=£.374 *Ans.*

(14) 4429÷43=103, and 240−103=137 *Ans.*

```
     £.                   s. d.
(15) 3)20                 6  8
     ------               2  0 add and subtract.
     0 6 8=B's share.     ----
     ------               4  8=A's share.
                          ----
                          8  8=C's share.
                          ====
```

(16) 1000−50=950. 950÷50=19 men, the *Ans.*

```
(17) 7847)3013248(384 Ans.          (18)  28604
          23541 ..                         1083
          -----                          ------
           65914                          85812
           62776                         228832
           -----                        286040
            31388                      --------
            31388                      30978132
            -----     remainder add        1788
            .....                      --------
            =====          dividend    30979920 Ans.
                                       ========
```

(19) £.12000÷20000=12*s*. *Ans.*

(20) 12*s*. 8*d*.÷7+1=8=1*s*. 7*d*. value of the purse

```
        s.  d.
        12  8
         1  7
        -----
Ans.    11  1
        =====
```

In giving a solution to the following questions, it will be necessary to give this rule. To the half sum, add the half difference of the two given numbers, the sum will be the greater number; or subtract the half difference from the half sum, the remainder will be the less number.

	cwt.	qr.	lb.		cwt.	qr.	lb.	oz.	
(21)	12	3	15÷2=		6	1	21	8	
	1	2	13÷2=		0	3	6	8	add and subtract.
					7	1	0	0	=greater weight.
					5	2	15	0	=lesser weight.

£.	s.	d.	
2)114	15	6	
57	7	9	
3	17	6	add and subtract.
61	5	3	=greater price.
53	10	3	=lesser price.

£.	s.	d.
2)7	15	0
3	17	6

(22) First 129+178=307. 1000−307=693. 693÷3=231=B's, 129+231=360=A's, and 231+178=409=C's share, the *Ans.*

EXAMPLES OF WEIGHTS AND MEASURES.

	lb.	oz.	dwts.	gr.	
(1)	8)83	5	10	17	by 8.
Ans.	10	5	3	$20\frac{1}{8}$	

	tons.	cwt.	qr.	lb.
(2)	9)29	17	0	18
Ans.	3	6	1	$11\frac{1}{3}$

	yds.	qr.	nls.
(3)	10)114	3	2
Ans.	11	1	$3\frac{4}{5}$

	miles	fur.	po.
(4)	11)1017	6	38
Ans.	92	4	$10\frac{8}{11}$

acres ro.po. ac.
(5) 26)2019 3 29(77
182.

199
182

17
4

26) 71 (2 *ro.*
52

19
40

26)789 (30 *po.*
78.

..9

Ans. 77*ac.* 2*ro.* 30*po.* $\frac{9}{26}$.

yrs. mo. w.d. ho. mi.yrs
(6) 37)117 7 3 5 11 27(3
111

6
13

37) 84 (2 *mo.*
74

10
4

37) 43(1 *we.*
37

6
7

37) 47 (1 *da.*
37

10
24

37)251 (6 *ho.*
222

29
60

37)1767 (47 *mi.*
148.

287
259

28

Ans. 3*yrs.* 2*mo.* 1*w.* 1*da.* 6*h.* 47*m.* $\frac{28}{37}$.

BILLS OF PARCELS.

(1)

£.	s.	d.
1	16	0
0	15	10
2	2	0
1	5	0
1	10	0
0	3	4
Ans. 7	12	2

(2)

£.	s.	d.
7	2	6
15	12	0
11	16	0
2	10	8
17	17	6
7	3	9
Ans. 62	2	5

(3)

£.	s.	d.
2	10	0
4	19	0
4	0	0
2	14	0
1	2	2
1	19	4½
Ans. 17	4	6½

(4)

£.	s.	d.
11	0	6
0	10	10
2	2	0
6	6	0
3	0	0
0	15	0
Ans. 23	14	4

(5)

£.	s.	d.
3	3	9
8	2	0
16	10	0
14	8	0
2	3	9
14	17	6
Ans. 59	5	0

(6)

£.	s.	d.
5	1	3
5	18	9
3	0	0
8	12	6
8	19	11
7	5	0
Ans. 38	17	5

(7)

£.	s.	d.
0	13	6½
0	14	4½
0	3	6
0	11	8
0	6	10½
0	12	10
Ans. 3	2	9½

(8)

£.	s.	d.
0	4	0
0	5	8
0	12	10
2	2	4
0	3	9
0	6	0
Ans. 3	14	7

(9)

£.	s.	d.
1	14	10
3	8	3
8	15	0
1	1	3
5	12	0
2	16	0
Ans. 23	7	4

REDUCTION OF MONEY.

(1)
£.
8
20
160 shillings.
12
1920 pence *Ans.*

(2)
£.
12
20
240 shillings.
12
2880
4
Ans. 11520 farthings.

(3)
4)311520
12)77880
2,0)649,0
Ans. 324 10 0

(4)
guin.
21
21
441
12
5292
4
Ans. 21168 farth.

(5)
£. s. d.
17 5 $3\frac{1}{4}$
20
345
12
4143
4
16573 farthings *Ans.*

(6)
£. s. d.
25 14 1
20
514
12
Ans. 6169 pence.

(7)
12)17940
5)1495
Ans. 299 crowns.

(8)
15
5
75 shillings.
2
Ans. 150 sixpences.

(9)
57
30
1710 pence.
4
6840 farth.

(10)
	farth.
52 crowns	=12480
52 half ditto	= 6240
52 shillings	= 2496
52 pence	= 208
Ans.	21424 farth.

(11)
4)17280
12)4320 pence.
2,0)36,0 shill.
Ans. 18£.

(12)
4)21168
12)5292
21)441
Ans. 21 guin.

(13)
4)16573
12)4143$\frac{1}{4}$
2,0)34,5 3
Ans. 17 5 3$\frac{1}{4}$

(14)
12)6169
2,0)51,4 1
25 14 1
Ans. 514*s.* £25. 14*s.* 1*d.*

(15) 4)6840
30)171,0 pence.
Ans. 57 half-crowns.

(16) 412)21424(52
2060
824
824
. . .
Ans. 52 of each.

d.
60
30
12
1
103
4
412

(17) 60 guineas.
21
5)1260 shillings.
4)252 crowns.
Ans. £.63

(18) 76 moid.
27
532
152
2,0)205,2 shillings.
102 12

(19) £. *s.*
102 12
20
27)2052(76
189
162
162
. . .
Ans. 2052*s.* 76 *moid.*

(20) £. *sixpences.*
556 2
40 5
10
17)22240 —
17
1308 2 =
Ans. 1308 of each, 2*s.* over.

(21)
8)1308
163 10 0
327 0 0
65 8 0
555 18 0

4)1308
327 0 0

2,0)130,8
65 8 0

```
      £.  s.           guin. s. d.              £.  s.  d.
(22) 15  10      (23) 103  7  0      (24)  12  12   0
          7             21                  1  12   0
     ------           ---------            ----------
     108 10         2,0)217,0              14   4   0
      20            ----------                      5
     ------         7)108 10  0            ----------
  21)2170           ----------             77   0   0
  --------       Ans. 15 10  0              5
Ans. 103 7 0     =============             ----------
=============                         Ans. 355  0   0
                                           ==========

(25) 3)50               4)50             5)50
     ---------          ---------        -----
     16 13  4           12 10  0         10
     20                 20               20
     ------             ------           -----
     333                250              200 boys.
      12                  2              -----
     ------             ------
  6,0)400,0            5)500
     ------             ------
     66 men, 3s. 4d. over.  100 women.
     ------             ------
  £.                          50  0  0
 6)50                        ---------
 ---------                    16 13  4
   8  6  8                    12 10  0
  20                          10  0  0
 ------                        8  6  8
 166                         ---------
  12               subtract 47 10  0 from £.50
 ------                      ---------
 9)2000                        2 10  0
 ------         3s. 4d.+2d.=0  3  6
 222 girls, 2d. over.        ---------
 ------                        2 13  6
                             =========
```

Ans. 66 men, 100 women, 200 boys, 222 girls, and £2. 13*s.* 6*d.* to the person that distributed it.

TROY WEIGHT.

```
      oz.
(26)  27
      20
     ----
     540
      24
     ----
Ans. 12960 grains.
```

```
         grains.
(27) 24)12960
        -------
       2,0)54,0
           ----
Ans. 27 ounces.
```

```
     lb. oz. dwt. gr.
(28)  3  10   7   5
     12
    ----
     46
     20
    ----
    927
     24
    ----
Ans. 22253 grains.
```

```
    lb. oz. dwt. gr.
(29) 7   4   17   15
                   8
    ------------------
    59   3    1    0=8 ingots.
    12
   ----
   711 ounces.  \
    20           |
  -----          |
  14221 dwts.    > Ans.
     24          |
  ------         |
 341304 grains. /
```

```
      lb. oz. dwt. gr.
(30)   7   4   17   15
      12
     ----
      88
      20
     ----
    1777
      24
    -----
    42663) 341304(8
           341304
           ------
Ans. 8 ingots. ......
```

```
     lb.  oz. dwt.
(31) 23   5    7
               7
    ---------------
    164   1    9=7 ingots.
     12
   -----
   1969
     20
   -----
   39389
     24
   ------
   945336 grains Ans.
```

```
     oz. dwt.         oz. dwt.
(32)  2  16           50   8
     20                  20
     --                 ----
     56            56)1008(18
     --                56 .
                       ---
                       448
                       448
                       ---
                       ...
Ans. 18 spoons.
```

	oz.	*dwt.*	*gr.*
(33)	137	6	9
	20		
	2746		
	24		
	65913 dividend.		

30924)65913 (2 of each.
61848

24) 4065 (16,9 (20)
24 . .
166
144
225
216
9

8 9

oz.	*dwt.*	*gr.*	
17	15	10	=tankard.
21	11	13	=spoon.
3	10	0	=salt.
21	11	13	=fork.
64	8	12	
20			
1288			
24			
30924 divisor.			

Ans. 2 of each sort, and 8*oz.* 9*dwt.* 9*gr.* over.

AVOIRDUPOISE WEIGHT.

oz.
(34) 16)14769
112)923 1

Ans. 8*cwt.* 0*qr.* 27*lb.* 1*oz.*

	cwt.	*qr.*	*lb.*	*oz.*
(35)	8	0	27	1
	4			

32 quarters.
28
923 pounds.
16
14769 ounces.

Ans. (quarters, pounds, ounces)

```
     cwt. qr. lb.
(36) 2  1  14=weight of 1 bag.
           4×8=32
     -----------
     9  2   0=weight of 4 ditto.
            8
     -----------
    76  0   0=weight of 32 ditto.
add  1  1  10=150 pounds.
     -----------
Ans. 77 1  10
```

```
     tons cwt. qr. lb.
(37) 34  17  1  19
          20
        ----
         697
           4
        ----
        2789
          28
        ----
Ans.   78111 pounds.
```

```
(38) 547×24/16=3/2
       3
     ----
   2)1641
     ----
Ans. 820lb. 8oz.
```

```
     cwt.        lb.
(39) 27×112=3024

     18)3024
        ----
Ans. 168 parcels.
```

```
     cwt. qr. lb.
(40) 9    2   14
     4
    ---
    38
    22
    ----
    1078 pounds Ans.
```

```
         cwt. qr. lb.
(41)      2    1   15
               3×9=27.
         -------------
          7    0   17
                    9
         -------------
         64    1   13
137lb.=   1    0   25
         -------------
Ans.     65    2   10
```

```
     cwt. qr.
(42)  8   3
          3×9=27
     --------
     26   1
          9
     --------
    236   1
      4
     ----
    945
     28
     -----
    26460 pounds Ans.
```

```
(43) 552×16/24=2/3
       2
     ----
   3)1104
     ----
Ans. 368 great pounds.
```

```
      lb. oz.          cwt. qr. lb.
(44)  16  2            16   1   15
      16                4
      ----             --
      258              65
      ----             28
                       ----
                       1835
                         16
                       ------
                 258)29360 (113 parcels.
                     258..
                     ----
                      356
                      258
                      ----
                       980
                       774
                       ----
                    16)206
                       ------
                       12 14
                       ======
```

Ans. 113 parcels, 12*lb.* 14*oz.*

APOTHECARIES' WEIGHT.

```
     ℔  ℥  ʒ  ℈  gr.                  grains.
(45) 27  7  2  1  2              (46) 2,0)15902,2
     12                                 ---------
     ---                                 3)7951 2
     331                                 --------
       8                                 8)2650 1
     ----                                --------
     2650                               12)331 2
        3                                -------
     ----                                 27 7
     7951                                 =====
       20
     ------
     159022 grains, Ans.
     ======
```

Ans. 27℔ 7℥ 2ʒ 1℈ 2*gr.*

CLOTH MEASURE.

(47) 27
4
108
4
Ans. 432 *nails.*

(48) 75
5
4)375
Ans. 93 3*qrs.*

yds. qrs.
(49) 93 3
4
5)375
Ans. 75 *ells.*

(50) 24
32
768
3
5)2304
Ans. 460*ells.* 4*qrs.*

(51) 17
27
459
3
4)1377
Ans. 344*yds.* 1*qr.*

(52) 27
27
729
5
4)3645
Ans. 911*yds.* 1*qr.*

yds. qr.
(53) 911 1
4
5)3645
Ans. 729 *ells.*

(54) 12 × 25 × 15 = 4500
4500
5
4)22500
Ans. 5625 *yds.*

LONG MEASURE.

(55) 57 × 8 × 40 = 456 furlongs × 40 = 18240 poles *Ans.*

(56) 7 × 1760 yards in a mile × 3 = 36960 feet × 12 = 443520 inches × 3 = 1330560 barley-corns, *Ans.*

```
(57)  40)18240 poles.
        ─────────
          8)456 furlongs. ⎫
          ───             ⎬ Ans.
            57 miles.     ⎭
           ═══
```

(58) 72 × 3 × 1760 = 216 miles × 1760 = 380160.
Ans. 380160 yards.

```
                          3
(59)  1760)380160(216 miles.     ⎫
           3520..   ───          ⎬ Ans.
           ────── 72 leagues.    ⎭
            2816   ═══
            1760
           ─────
           10560
           10560
           ─────
           .....
           ═════
```

(60) 50 × 3 × 1760 = 150 miles × 1760 = 264000 yards × 3 = 792000 feet × 12 = 9504000 inches × 3 = 28512000 barley-corns.

(61) 100 miles × 1760 × 3 = 528000 feet in 100 miles. 360 × 69½ = 25020 miles circumference × 1760 = 44035200 yards.

```
17)528000 (31058 14/17 times round, Ans.
   51....
  ───                (62)  360
   18                       69½
   17                     ──────
  ───                      3240
   100                    2160
    85                     180
  ────                   ────────
    150                   25020 miles.
    136                  190080 barley-corns.
   ────                ─────────────
     14                  20016 in a mile.
   ════                22518
                       2502
                       ─────────────
                       4755801600 Ans.
                       ═════════════
```

LAND MEASURE.

(63) 27 acres × 4 × 40 = 108 roods × 40 = 4320 perch. *Ans.*

(64) 4,0)432,0

4)108

Ans. 27 acres.

(65)

ac.	ro.	po.
37	0	1
15	0	0
22	0	1
4		
88		
40		

Ans. 3521 perches.

(66)

ac.	ro.	po.	
5	0	0	first field.
4	0	2	second.
7	3	0	third.
2	1	0	fourth.
19	0	2	
4			
76			
40			

75)3042(40
300 .

42

Ans. 40 shares, and 42 perches.

WINE MEASURE.

(67) 5 tons × 252 gallons in a ton = 1260 gallons, 1260 × 8 = 10080 pints, *Ans.*

(68) 10080 pints ÷ 8 = 1260 gallons. 1260 ÷ 252 = 5 tons, *Ans.*

(69) 126 gallons in a pipe.
63 gall. in a hogshead.

189)5896 (31
567.

226
189

37

Ans. 31 of each, and 37 gallons over.

(70) gal. pints.
126 × 8 = 1008 in a pipe.
pint
1 3)1008
2
— 12)336
3
— *Ans.* 28 doz. of each.

ALE AND BEER MEASURE.

(71) 46
36 gallons in a barrel.

1656 gallons.
8

13248 pints, *Ans.*

(72) 32 gallons in a barrel.
10

320 gallons.
4

1280 quarts, *Ans.*

hhds.
(73) 72 × 3 = 216.
216 ÷ 2 = 108 barr. *Ans.*

(74) 108 × 9 = 216
216 ÷ 3 = 72 hhds. *Ans.*

DRY MEASURE.

(75) 120 × 8 = 960 bushels. 960 × 4 = 3840 pecks. 3840 × 2 = 7680 gallons. 7680 × 4 = 30720 quarts. *Ans.*

(76) 30720 quarts ÷ 4 × 8 × 8 = 7680 ÷ 8 × 8 = 960 ÷ 8 = 20 quarters, *Ans.*

(77) 20 × 36 × 4 = 720 × 4 = 2880 pecks, *Ans.*

(78) 273 lasts × 10 = 2730 quarters. 2730 × 8 × 4 = 20840 × 4 = 87360 pecks, *Ans.*

TIME.

(79) 4)72015

6)18003¾

4×6=24.

7)3000 15 ho.

Ans. 428*we.* 4*da.* 15*ho.*

(80) 8766 hours in a year.

```
        8766 hours in a year.
        1794
       -----
       35064
      78894
     61362
     8766
   ---------
6×4=24)15726204 hours.
   ---------
Ans. 655258½ days.
```

(81)

```
      1108
      1794
      ----
      2902 years.
      8766
     -----
     17412
    17412
   20314
  23216
  --------
Ans. 25438932 hours.
```

(82) From Nov. 17, to Sept. 12, the next year, are (by inspecting the table at the end of the Arithmetic) 299 days, *Ans.*

(83) From July 18, to Dec. 27, (by the same table,) are 162 days, *Ans.*

(84) From July 18, 1723, to April 18, 1724, are 274 days, 1750 − 1724 = 26 years.

$$\begin{array}{r} 365\tfrac{1}{4} \\ 26 \\ \hline 2190 \\ 730 \\ 6\tfrac{1}{2} = \tfrac{1}{4} \text{ of } 26 \\ \hline 9496 \\ \text{add } 274 \\ \hline \textit{Ans. } 9770\tfrac{1}{2} \text{ days.} \end{array}$$

THE

SINGLE RULE OF THREE DIRECT.

(1) Stated thus, if 1*lb.* : $4\frac{1}{2}$*d.* : : 54*lb.* then $54 \times 4\frac{1}{2} = 216 + 27 = 243$*d.* = 20*s.* 3*d.* = 1*l.* 0*s.* 3*d.* *Ans.*

(2) Stated thus, if 1 *gal.* : 10*d.* : : 36 *gals.* : 360*d.* = 30*s.* = 1*l.* 10*s.* *Ans.*

(3) Stated thus, if 1 pair : 4*s.* 6*d.* : : 12 *doz.* = 144 pair, then $144 \times 4\frac{1}{2}$*s.* = 648*s.* = 32*l.* 8*s.* *Ans.*

(4) Stated thus, if 1 *yd.* : 15*s.* 6*d.* : : 32*yds.* then 15*s.* 6*d.* × 4 × 8 = 62*s.* × 8 = 496*s.* = 24*l.* 16*s.* *Ans.*

(5) Stated thus, if 32 *yds.* : 24*l.* 16*s.* : : 1 *yard*, then 24*l.* 16*s.* ÷ 32 (4 × 8) = 6*l.* 4*s.* ÷ 8 = 124*s.* ÷ 8 = 15*s.* 6*d.* *Ans.*

(6) Stated thus, if 112*lb.* : 4*l.* 18*s.* : : 1*lb.* then 4*l.* 18*s.* = 98*s.* = 1176*d.* this divided by 112 = or gives $10\frac{1}{2}$*d.* *Ans.*

(7) First 20 × 20 = 400 *ells.* If 1 *ell* : 12*s.* 6*d.* : : 400*ells.* Then 12*s.* 6*d.* × 10 × 10 × 4 = (400) gives 125*s.* × 10 × 4 = 5000*s.* = £250. *Ans.*

(8) First 25*cwt.* 3*qrs.* 14*lb.* = 103*qrs.* 14*lb.* = 2898*lb.* Stated thus, if 1*lb.* : $15\frac{1}{2}$*d.* : : 2898*lb.* then 2898*lb.* × $15\frac{1}{2}$*d.* = 44919*d.* which, divided by 12 and 20, will give 187*l.* 3*s.* 3*d.* *Ans.*

(9) Stated thus, if 1*yd.* : 6*s.* $9\frac{1}{2}$*d.* : : $27\frac{1}{4}$*yds.* then 6*s.* $9\frac{1}{2}$*d.* $\times 27\frac{1}{2} = (\overline{3\times 9+\frac{1}{4}})$ 1*l.* 0*s.* $4\frac{1}{2}$*d.* $\times 9 =$ 9*l.* 3*s.* $4\frac{1}{2}$*d.* then 9*l.* 3*s.* $4\frac{1}{2}$*d.* $+ \dfrac{6s\ 9\frac{1}{2}d.}{4} =$ 9*l.* 3*s.* $4\frac{1}{2}$*d.* + 1*s.* $8\frac{1}{4}$*d.*—2 rem. = 9*l.* 5*s.* $0\frac{3}{4}$*d.*—2 rem. *Ans.*

(10) First 17*cwt.* 1*qr.* 14*lb.* = 69*qrs.* 14*lb.* = 1946*lbs.* Stated thus, if 1*lb.* : $3\frac{1}{4}$*d.* : : 1946*lb.* then $1946 \times 3\frac{1}{4}$*d.* = $6324\frac{1}{2}$*d.* = 527*s.* $0\frac{1}{2}$*d.* = 26*l.* 7*s.* $0\frac{1}{2}$*d.* *Ans.*

(11) First 2*cwt.* = 224*lb.* = 3584*oz.* Stated thus, if 1*oz.* : $5\frac{1}{2}$*d.* : : 3584*oz.* then $3584 \times 5\frac{1}{2}$*d.* = 19712*d.* = 1642*s.* 8*d.* = 82*l.* 2*s.* 8*d.* *Ans.*

(12) First 2*l.* 14*s.* 3*d.* = 54*s.* 3*d.* = 651*d.* = 2604*qrs.* and 21*l.* 11*s.* $1\frac{1}{2}$*d.* = 431*s.* $1\frac{1}{2}$*d.* = $5173\frac{1}{2}$*d.* = 20694*qrs.* Stated thus, if 2604*qrs.* : $3\frac{1}{2}$ *yds.* : : 20694*qrs.* then $20694 \times 3\frac{1}{2} =$ 72429, this divided by 2604 will give 27*yds.* 3*qrs.* 1*nl.* —84 rem. *Ans.*

(13) Stated thus, if 112*lb.* : 1*l.* 14*s.* 8*d.* : : $3\frac{1}{2}$*lb.* then 1*l.* 14*s.* 8*d.* $\times 3\frac{1}{2} =$ 34*s.* 8*d.* $\times 3\frac{1}{2} =$ 121*s.* 4*d.* this divided by 112 gives 1*s.* 1*d.* *Ans.*

(14) First 1*cwt.* 0*qrs.* $24\frac{1}{2}$*lb.* = $136\frac{1}{2}$*lb.* = $273\frac{1}{2}$*lb.* and 112*lb.* $\times 2 = 224$. Stated thus, if 224 : 9*s.* : : 273, then 273 $\times 9 = 2457$, this divided by 224 gives 10*s.* $11\frac{1}{2}$*d.* $\frac{112}{224} =$ 10*s.* $11\frac{1}{2}$*d.* $\frac{1}{2}$ rem. *Ans.*

(15) Stated thus, if 1 *day* : 19*s.* 4*d.* : : 365 *days*, then 19*s.* 4*d.* $\times \overline{6\times 6\times 10} + 5 =$ 5*l.* 16*s.* 0*d.* $\times \overline{6\times 10+5} =$ 34*l.* 16*s.* $\times 10+5 =$ £348. $+ \overline{5\times 19s.\ 4d.} =$ 352*l.* 16*s.* 8*d.*

	£.	s.	d.
then from	500	0	0
take	352	16	8
Ans.	147	3	4

(16) First 14*yds.* = 56*qrs.* 10 guineas = 10*l.* 10*s.* = 210*s.* 283*l.* 17*s.* 6*d.* = 5677*s.* 6*d.* Stated thus, if 210*s.* : 56*qrs.* : : $5677\frac{1}{2}$*s.* then $\times 5677\frac{1}{2} \times 8 \times 7$ (or 56 = $45420 \times 7 =$ 317940*qrs.* which divided by 210 gives 1514*qrs.* = 504 *ells Flem.* 2*qrs.* *the Ans.* Or multiply $5677\frac{1}{2}$ by 8 and divide the product by 90, thus $\overline{5677\frac{1}{2}\times 8} \div 90 = 45420 \div$ $90 = 504\frac{2}{3} =$ 504 *ells Flem.* 2*qrs.* the same as before.

(17) Stated thus, if $504\frac{2}{3}$*yds.* : 283*l.* 17*s.* 6*d.* : : 14*yds.* = 56*qrs.* then 283*l.* 17*s.* 6*d.* $\times \overline{8 \times 7}$ = £2271. × 7 = £15897 this divided by $504\frac{2}{3}$ *ells Flem.* or 1514*qrs.* = £10.$\frac{757}{1514}$ = £$10\frac{1}{2}$. or = 10*l.* 10*s.* *Ans.*

(18) Stated thus, if 3*lb.* : 1*l.* 1*s.* 8*d.* : : 29*lb.* 4*oz.* then 1*l.* 1*s.* 8*d.* $\times \overline{7 \times 4}$ + $1\frac{1}{4}$ = 7*l.* 11*s.* 8*d.* × 4 + $1\frac{1}{4}$ = 30*l.* 6*s.* 8*d.* + 1*l.* 1*s.* 8*d.* + 5*s.* 5*d.* = 31*l.* 13*s.* 9*d.* this divided by 3 gives 10*l.* 11*s.* 3*d.* *Ans.*

(19) Stated thus, if 1*ell* 2*qrs.* = 7*qrs.* : 4*s.* 7*d.* : : 39*yds.* 2*qrs.* = 158*qrs.* then 4*s.* 7*d.* × 158 = 158 × 55*d.* = 158 × 5 × 11 = 790 × 11 = 8690*d.* this divided by 7 gives $1241\frac{3}{7}$*d.* = 103*s.* $5\frac{3}{7}$*d.* = 5*l.* 3*s.* $5\frac{1}{4}$*d.* $\frac{5}{7}$ = *Ans.*

(20) First 1*oz.* = 20*dwts.* = 480*gr.* If 480*gr.* : 5*l.* 4*s.* 2*d.* : : 1*gr.* then 5*l.* 4*s.* 2*d.* ÷ 480 = 104*s.* 2*d.* ÷ 480 = 1250*d.* ÷ 480 = 2*d.*$\frac{290}{480}$ = $2\frac{1}{2}$*d.*$\frac{5}{12}$ *Ans.*

(21) Stated thus, if 14*yds.* : 9*l.* 12*s.* : : 75*yds.* then 9*l.* 12*s.* × 3 × 5 × 5, or by 75 = 28*l.* 16*s.* × 5 × 5 = £144 × 5 = £720. this divided by 14 gives £51$\frac{6}{14}$. = 51*l.* 8*s.* $6\frac{3}{4}$*d.* $\frac{3}{7}$ rem. *Ans.*

(22) Stated thus, if 5*l.* 12*s.* 6*d.* = 225 sixpences : 27*yds.* = 108*qrs.* : : £100. = 4000 sixpences, then 4000 × 108 = 432000, this divided by 225 = 1920*qrs.* divide this by 5 gives 384 *ells*, the *Ans.*

(23) Stated thus, if 1*cwt.* = 112*lb.* : 12*l* 12*s.* 6*d.* : : 14*cwt.* 1*qr.* 19*lb.* = 57*qrs.* 19*lb.* = 1615*lb.* then 12*l.* 12*s.* 6*d.* 505 sixpences × 1615 = 815575, this divided by 112 = 7281 sixpences $5\frac{1}{2}$*d.* 8 rem. = 182*l.* 0*s.* $11\frac{1}{2}$*d.* 8 rem. *Ans.*

(24) First 5 pieces × $27\frac{1}{2}$ = $137\frac{1}{2}$ *yds.* in 5 pieces. If 7*yds.* : 17*s.* 8*d.* : : 135*yds.* then 17*s.* 8*d.* × $137\frac{1}{2}$, or $\overline{12 \times 11}$ + $5\frac{1}{2}$ = 10*l.* 12*s.* × 11 + $5\frac{1}{2}$ = 116*l.* 12*s.* + $\overline{5\frac{1}{2} \times 17s.}$ 8*d.* = 116*l.* 12*s.* + 4*l.* 17*s.* 2*d.* = 121*l.* 9*s.* 2*d.* divided by 7, gives 17*l.* 7*s.* $0\frac{1}{4}$*d.* $\frac{1}{7}$ rem. *Ans.*

(25) First 7*oz.* 11*dwts.* = 151*dwts.* 14*lb.* 9*oz.* 12*dwts.* 16*gr.* = 177*oz.* 12*dwts.* 16*gr.* = 3552*dwts.* 16*gr.* = $3552\frac{2}{3}$ *dwts.* If 151*dwts.* = 453 : £35. : : $3552\frac{2}{3}$*dwts.* = 10658, then £35. × 10658 × 10658 + 5 × 7 = 53290 × 7 = 373030, this divided by 453 = 823*l.* 9*s.* $3\frac{1}{4}$*d.* $\frac{23}{151}$ *Ans.*

(26) Stated thus, if 1 *ell Eng.* = 5*qrs.* : 14*s.* $10\frac{3}{4}$*d.* : : 420*yds.* = 1680*qrs.* = 6 × 7 × 4 × 10, then 14*s.* $10\frac{3}{4}$*d.* × 6 × 7

×4×10=4*l.* 9*s.* 4½*d.*×7×4×10=31*l.* 5*s.* 7½*d.*×4×10 =125*l.* 2*s.* 6*d.*×10=1251*l.* 5*s.* this divided by 5= 250*l.* 5*s.* *Ans.*

(27) First 14*lb.* 3*oz.* 8*dwts.*=171*oz.* 8*dwts.*=3428*dwts.* and 1*oz.*=20*dwts.* then if 3428*dwts.*. : 514*l.* 4*s.* : : 20*dwts.* then 514*l.* 4*s.*×20=£10284. this divided by 3428= £3. *Ans.*

(28) First 6*cwt.* 2*qrs.* 14*lb.*×4=26*cwt.* 2*qrs.*=106*qrs.* 1*cwt.*=4*qr.* then if 4*qr.* : 2*l.* 8*s.* 6*d.* : : 106*qr.* then 2*l.* 8*s.* 6*d.* ×106=2*l.* 8*s.* 6*d*×10×10+6=24*l.* 5*s.*×10+6= 242*l.* 10*s.*+2*l.* 8*s.* 6*d.*×6=242*l.* 10*s.*+14*l.* 11*s.*=257*l.* 1*s.* this divided by 4=64*l.* 5*s.* 3*d.* *Ans.*

(29) First 8×4×10×26=8320 *yds.* then if 6*yds.* : 4*l.* 16*s.* : : 8320 *yds.* then 4*l.* 16*s.*×8320=96*s.*×8320= 798720*s.* this divided by 6, and then by 20=£6656. *Ans.*

(30) First 3*qr.* 18*lb.*×18 = 3*qr.* 18*lb.*×3×6 =2*cwt.* 2*qr.* 26*lb.*×6=16*cwt.* 1*qr.* 16*lb.*=1836*lb.*
If 24*lb.* : 6*s.* 6*d.* : : 1836*lb.* then 6*s.* 6*d.*×153=6*s.* 6*d.*×
Or 2 153 [12×12+9=3*l.* 13*s*×12
+9=46*l.* 16*s.*+6*s.* 6*d.*×9 = 46*l.* 16*s.*+2*l.* 18*s.* 6*d.*= 49*l.* 14*s.* 6*d.* this divided by 2=24*l.* 17*s.* 3*d.* *Ans.*

(31) First 7*lb.* 5*oz.* 10*dwt.*=89*oz.* 10*dwt.*=1790*dwts.* 1790×14=25060*dwt.*=weight of 14 ingots. If 1*oz.*= 20*dwts.* : 5*s.* : : 25060*dwts.* then 25060×5=125300, this divided by 20=6265*s.*=313*l.* 5*s.* *Ans.*

(32) First 2*cwt.* 1*qr.* 19*lb.*−9*qr.* 19*lb.*=271*lb.* If 14*lb.* : 8*s.* 6*d.* : : 271*lb.* then 8*s.* 6*d.*×271 = 2303*s.* 6*d.* = 115*l.* 3*s.* 6*d.* this divided by 14=8*l.* 4*s.* 6¼*d.* $\frac{5}{7}$ *Ans.*

(33) First 59*cwt.* 2*qr.* 24*lb.*=238*qrs.* 24*lb.* = 6688. If 112*lb.* : 2*l.* 17*s.* 4*d.* : : 6688, then 2*l.* 17*s.* 4*d.*×418=
Or 7 418 [2*l.* 17*s.* 4*d.*×11×38=
31*l.* 10*s.* 8*d.*×6×6+2=189*l.* 4*s.*×6+2 =1135*l.* 4*s.*+ 31*l.* 10*s.* 8*d.*×2=1135*l.* 4*s* +63*l.* 1*s.* 4*d.*=1198*l.* 5*s.* 4*d.* this divided by 7=171*l.* 3*s.* 7¼*d.* $\frac{5}{7}$ rem. *Ans.*

(34) First 171 *tons*×14= £2394. £2394+4*l.* 10*s.*= 2398*l.* 10*s.* value of the lead. 171 *tons*=3420*cwt.*=

F

383040*lb.* If 383040*lb.* : 2398*l.* 10*s.* : : 1*lb.* then 2398*l.* 10*s.* =47970*s.*=575640*d.*÷383040=1$\frac{1}{2}$*d.* $\frac{3}{266}$ rem. *Ans.*

(35) Stated thus, if 10 groats=3*s.* 4*d.*=40*d.* : 1 pair : : 43*l.* 5*s.* = 865*s.* = 10380*d.* then 10380*d.*÷40*d.* = 259$\frac{1}{2}$ pairs, which divided by 12=21doz. 7$\frac{1}{2}$ pair, *Ans.*

(36) First 27*doz.* 5*lb.* =329*lb.* then if 3*lb.* : 17*d.* : : 329*lb.* then 329 × 17÷3=5593$\frac{1}{3}$÷3=1864$\frac{1}{3}$*d.*=155*s* 4$\frac{1}{4}$*d.* $\frac{1}{3}$ =7*l.* 15*s.* 4$\frac{1}{4}$*d.* $\frac{1}{3}$ *Ans.*

(37) First 3 *lb.* 7 *oz.* 14 *dwts.* 21 *grs.* × 7 ingots = 25*lb.* 6*oz.* 4*dwts.* 3*gr.*=146979*gr.* 1*oz.*=20*dwts.* 480*gr.* If 480*grs.* : 3*l.* 10*s.* : : 146979*grs.* then 146979 × 3*l.* 10*s.* or 70*s.*=1088530*s.* this being divided by 480=6 × 8 × 10 = 1714755 ÷ 8 × 10 = 214344$\frac{3}{8}$÷10 = 21434*s.* 5$\frac{1}{4}$*d.* = 1071*l.* 14*s.* 5$\frac{1}{4}$*d.* *Ans.*

(38) First 9$\frac{1}{2}$*d.* × 11=104$\frac{1}{2}$*d.*=charge of 11 horses for one day. If 1 day : 104$\frac{1}{2}$*d.* : : 365 days, then 104$\frac{1}{2}$*d.* × 365 =38142$\frac{1}{2}$*d.*=3178. 0*s.* 6$\frac{1}{2}$*d.*=158*l.* 18*s.* 6$\frac{1}{2}$*d.* *Ans.*

(39) First, if 4*s.* 10*d.* : 1*yd.* : : 517*l.* 19*s.* 4*d.*=10359*s.* 4*d.* = 124312*d.* this divided by 58*d.* = (4*s.* 10*d.*) gives 2143*yds.* 1*qr.*—14 rem. of cloth, then 2143*yds.* 1*qr.*÷86 =24*yds.* 3*qrs.* 2*nls.*=19*ells Eng.* 4*qrs.* 2*nls.*—64 rem. in one piece, *Ans.*

(40) First 10*moid.* × 4=40*moid.*=1080*s.*=£54.

	£.	s.	d.		£.	
From	896	17	0		54	
Take	264	0	0		210	=200 guineas.
	632	17	0	=what he spends per annum	264	

If 365 days : 632*l.* 17*s.* : : 1 day, then 632*l.* 17*s.*÷365= 1*l.* 14*s.* 8*d.*—44 rem. *Ans.*

THE RULE OF THREE INVERSE.

```
      men days   men
(1) As 8 : 12 : : 16
               8
           ────
        16)96(6
           96
           ────
           ..
           ════
   Ans. 6 days.
```

```
       days  men   days
(2) If 90 : 54 : : 50
    Or  9 : 54 : :  5 then 54×9
        =486, this divided by 5
        97⅕ men, Ans.
```

(3) Stated thus, if 2*s.*=24*d.* : 8*oz.* : : 1*s.* 6*d.*=18*d.* then 24×8=192 and 192÷18=$10\frac{12}{18}$*oz.*=10*oz.* $10\frac{2}{3}$*dr.* *Ans.*

(4) Stated thus, if 12*s.* : 240 pieces, : : 20*s.* then 240×
3   5
3÷5=720÷5=144 pieces, *Ans.*

(5) Stated thus, if 5*qrs.* : 30*yds.* : : 3*qrs.* then 30×5÷3 =150÷3=50*yds.* *Ans.*

(6) Stated thus, if £200 : 12 months, : : £150 then
Or 4   3
12 months×4÷3=48÷3=16 months, *Ans.*

(7) Stated thus, if 36 miles : 1200*lbs.* : : 24 miles, then
Or 3   2
1200*lb.*×3÷2=1800*lb.* *Ans.*

(8) Stated thus, if 12 days : 108 men : : 3 days, then 108
4   1
×4=432 men, *Ans.*

(9) Stated thus, if 3 months : 1000 men : : 6 months : 500 men kept, and, as it is the half, it must be the *Ans.*

(10) Stated thus, if £30 : 100 men : : £24 then 100×
Or 5   4
5÷4=125 men, *Ans.*

(11) Stated thus, if 12 hours : 24 days : : 16 hours, then
Or 3   4
24×3÷4=72÷4=18 days, *Ans.*

(12) Stated thus, if 7*qrs.* : 4*yds.* : : 3*qrs.* then 4×7÷3 =28÷3=$9\frac{1}{3}$*yds.* *Ans.*

(13) Stated thus, if 14 men : 18 days : : 34 men, then 18
Or 7 17
$\times 7 \div 17 = 126 \div 17 = 7\frac{7}{17}$ days $= 7$*da.* 4*ho.* $56\frac{8}{17}$*mi.* $=$ *Ans.* at 12 hours for a day.

(14) Stated thus, if 8 months : £64 : : 12 months, then $64 \times 8 \div 12 = 512 \div 12 = £42\frac{2}{3} = 42$*l.* 13*s.* 4*d.* *Ans.*

(15) First $2\frac{1}{2} = 1000 = 2500$*yds.* If 5 *qrs.* : 2500*yds.* : : 3*qrs.* then $2500 \times 5 \div 3 = 12500 \div 3 = 4166\frac{2}{3} = 4166$*yds.* 2*qrs.* 2*nls.* 2 rem. *Ans.*

THE DOUBLE RULE OF THREE.

(1) First place the numbers thus,

$$\begin{array}{ccc} \textit{ho.} & \textit{da.} & & \textit{bu.} \\ 14 & 16 & : : & 56 \\ 20 & 24 & & \end{array}$$

By the fourth rule, $\dfrac{20 \times 24 \times 56}{14 \times 16} = \dfrac{20 \times 3 \times 56}{14 \times 2} = \dfrac{20 \times 3 \times 8}{2 \times 2} = \dfrac{480}{4} = 120.$ *Ans.* 120 bushels.

(2) Placed thus,

$$\begin{array}{ccccc} \textit{men} & \textit{da.} & & \textit{ac.} \\ 8 & 14 & : : & 112 \\ - & 10 & : : & 2000 \end{array}$$

By the fifth rule, $\dfrac{8 \times 14 \times 2000}{10 \times 112} = \dfrac{8 \times 2000}{10 \times 8} = \dfrac{2000}{10} = 200$ men, *Ans.*

(3) Placed thus,

$$\begin{array}{cccc} \textit{men} & \textit{mo.} & & £ \\ 100 & 12 & : : & 6 \\ 75 & 9 & : : & - \end{array}$$

By the fourth rule, $\dfrac{75 \times 6 \times 9}{100 \times 12} = \dfrac{75 \times 9}{100 \times 2} = \dfrac{3 \times 9}{4 \times 2} = \dfrac{27}{8} =$ 3*l.* 7*s.* 6*d.* *Ans.*

(4) Placed thus,

$$\begin{array}{lccccc} & \textit{lbs.} & & \textit{miles} & & \textit{s.} \\ & 336 & : & 150 & : & 42 \\ 7\textit{cwt.}\ 3\textit{qr.}\ 14\textit{lbs.} = & 882 & : & 50 & : & - \end{array}$$

By the fourth rule, $\dfrac{882 \times 50 \times 42}{336 \times 150} = \dfrac{882 \times 42}{336 \times 3} = \dfrac{882 \times 14}{336} = \dfrac{441 \times 14}{168} = \dfrac{441 \times 7}{84} = \dfrac{441}{12} =$ 36*s.* 9*d.* $=$ 1*l.* 16*s.* 9*d.* *Ans.*

men days qrs.
(5) Placed thus, 136 : 108 : 351
11232 : 56 : —

By the fourth rule, $\frac{351 \times 11232 \times 56}{136 \times 108} = \frac{351 \times 11232 \times 7}{17 \times 108}$
$= \frac{351 \times 936 \times 7}{17 \times 9} = \frac{351 \times 104 \times 7}{17} = \frac{255528}{17} = 15031\frac{1}{17}$ *qrs.* *Ans.*

men da. ac.
(6) Placed thus: 8 : 7 : 40
24 : 28 : —

By the fourth rule, $\frac{40 \times 24 \times 28}{8 \times 7} = \frac{40 \times 24 \times 4}{8} = 5 \times 24 \times 4$
$= 480$ acres, *Ans.*

men da. s.
(7) Placed thus, 8 : 5 : 40
32 : 24 : —

By the fourth rule, $\frac{40 \times 32 \times 24}{8 \times 5} = 32 \times 24 = 768s. =$
38*l.* 8*s.* *Ans.*

£. mo. £.
(8) Placed thus, 100 : 12 : 6
— : 9 : 3*l.* 7*s.* 6*d.*

By the fifth rule, $\frac{100 \times 12 \times 3l.\,7s.\,6d.}{6 \times 9} = \frac{100 \times 2 \times 3l.\,7s.\,6d.}{9}$
$= \frac{337l.\ 10s. \times 2}{9} = \frac{675}{9} = £75.$ *Ans.*

men days qrs.
(9) Placed thus, 939 : 168 : 351
— : 56 : 1404

By the fifth rule, $\frac{939 \times 168 \times 1404}{351 \times 56} = \frac{939 \times 3 \times 1404}{351} =$
$\frac{939 \times 1404}{117} = \frac{313 \times 1404}{39} = \frac{313 \times 468}{13} = 313 \times 36 = 11268$
soldiers, *Ans.*

per. da. kild.
(10) Placed thus, 7 : 12 : 2
14 : 8 : —

By the fourth rule, $\frac{2 \times 14 \times 8}{7 \times 12} = \frac{2 \times 2 \times 8}{12} = \frac{2}{3} = 2$ *kil.*
12 *gal.* *Ans.*

(11) Placed thus,
$$\begin{matrix} cwt. & mi. & £. & s. & d. \\ 60 : & 20 : & 14 & 10 & 0 \\ — : & 30 : & 5 & 8 & 9 \end{matrix}$$

By the fifth rule, $\frac{60\times 20\times 5l.\ 8s.\ 9d.}{30\times 14l.\ 10s.}$ = 14*l*. 10*s*. = 290*s*. = 3480*d*. 5*l*. 8*s*. 9*d*. = 108*s*. 9*d*. = 1305*d*. $\frac{60\times 20\times 1305}{30\times 3480}=\frac{2\times 20\times 1305}{3480}=\frac{2\times 1305}{174}=\frac{1305}{87}=\frac{435}{29}$ = 15*cwt*. *Ans.*

(12) Placed thus,
$$\begin{matrix} horses & days & bu. & qr. \\ 2 : & 16 : & 8 = & 1 \\ - : & 24 : & 3000 & \end{matrix}$$

By the fifth rule, $\frac{2\times 16\times 3000}{24\times 1}=\frac{2\times 2\times 3000}{3}=\frac{12000}{3}=$ 4000 horses, *Ans.*

(13) Placed thus,
$$\begin{matrix} £. & year & £. \\ 100 : & 1 : & 7 \\ 571 : & 6 : & - \end{matrix}$$
12 months = 1 year.

By the fourth rule, $\frac{7\times 571\times 6}{100\times 1}=\frac{3997\times 6}{100}=\frac{23982}{100}=$ 239*l*. 16*s*. $4\frac{3}{4}$*d*. $\frac{1}{5}$ rem. *Ans.*

(14) Placed thus,
$$\begin{matrix} tons. & cwt. & miles & s. \\ 2 = & 40 : & 6 : & 10 \\ 12 : 17 = & 257 : & 17 : & — \end{matrix}$$

By the fourth rule, $\frac{257\times 10s.\times 17}{40\times 6}=\frac{257\times 17}{2\times 40\times 6}=\frac{4369}{480}=$ 9*l*. 2*s*. $0\frac{1}{2}$*d*. *Ans.*

Or thus by two statings, if 2*tons* : 10*s*. : : 12*tons* 17*cwt*.
10
—
then 12*tons* 17*cwt*. × 10 = 128*tons* 10*cwt*. this divided by 2 = 64*s*. 3*d* = 3*l*. 4*s*. 3*d*.

If 6 miles : 3*l*. 4*s*. 3*d*. : : 17 miles, then 3*l*. 4*s*. 3*d*. × 17 = 3*l*. 4*s*. 3*d*. × 4 × 4 + 1 = 51*l*. 8*s*. + 3*l*. 4*s*. 3*d*. = 54*l*. 12*s*. 3*d*. which divided by 6 = 9*l*. 2*s*. $0\frac{1}{2}$*d*. *Ans.*

For in many cases this is the best way, as it discovers whether the statings are direct or inverse, so that the terms which are divisors become known, and also those of the dividend, then those terms which are multiples of each other may be left out, and the work much abbreviated.

PRACTICE.

RULE I.

```
          lb.
(1) 1/4 is 1/4)5704
         ------
         12)1426
         -------
       2,0)11,8 10
         ---------
       £5 18 10 Ans.
```

```
          lb.
(2) 1/2 is 1/2)7695
         ------
         12)3847 1/2
         -------
       2,0)32,0 7 1/2
         ---------
       £16 0 7 1/2 Ans.
```

```
          lb.
(3) 1/2 is 1/2)5740
         ------
         12)2870
         -------
       2,0)23,9 2
         ---------
       £11 19 2 Ans.
```

```
          lb.
(4) 1/2 is 1/2)6547
         ------
    1/4 is 1/2)3273 1/2
               1636 3/4
         ---------
         12)4910 1/4
         ---------
       2,0)40,9 2 1/4
         ---------
       £20 9 2 1/4 Ans.
```

```
          lb.
(5) 1/2 is 1/2)4573
         ------
    1/4 is 1/2)2286 1/2
         ---------
               1143 1/4
         ---------
         12)3429 3/4
         ---------
       2,0)28,5 9 3/4
         ---------
       £14 5 9 3/4 Ans.
```

RULE II.

(1) 1*d.* is $\frac{1}{12}$)7547

2,0)62,8 11

£31 8 11 *Ans.*

(2) 1*d.* is $\frac{1}{12}$)3751 at 1$\frac{1}{4}$*d.*

$\frac{1}{4}$ is $\frac{1}{4}$)312 7

78 1$\frac{3}{4}$

2,0)39,0 8$\frac{3}{4}$

£19 10 8$\frac{3}{4}$ *Ans.*

(3) 1$\frac{1}{2}$ is $\frac{1}{8}$)54325

2,0)679,0 7$\frac{1}{2}$

£339 10 7$\frac{1}{2}$ *Ans.*

(4) 1$\frac{1}{2}$*d.* is $\frac{1}{8}$)6254

$\frac{1}{4}$ is $\frac{1}{6}$)781 9

130 3$\frac{1}{2}$

2,0)91,2 0$\frac{1}{2}$

£45 12 0$\frac{1}{2}$ *Ans.*

(5) 2*d.* is $\frac{1}{6}$)2351

2,0)39,1 10

£19 11 10 *Ans.*

(6) 2*d.* is $\frac{1}{6}$)7210

$\frac{1}{4}$ is $\frac{1}{8}$)1201 8

150 2$\frac{1}{2}$

2,0)135,1 10$\frac{1}{2}$

£67 11 10$\frac{1}{2}$ *Ans.*

(7) 2*d.* is $\frac{1}{6}$)2710

$\frac{1}{2}$ is $\frac{1}{4}$)451 8

112 11

2,0)56,4 7

£28 4 7 *Ans.*

(8) 2*d.* is $\frac{1}{6}$)3250

$\frac{1}{2}$ is $\frac{1}{4}$)541 8

$\frac{1}{4}$ is $\frac{1}{2}$)135 5

67 8$\frac{1}{2}$

2,0)74,4 9$\frac{1}{2}$

£37 4 9$\frac{1}{2}$ *Ans.*

```
(9) 3d. is 1/4)2715
           ────────
        2,0)67,8 9
           ────────
        £33 18 9 Ans.
        ═════════
```

```
(10) 3d. is 1/4)7062
               ──────
   1/4 is 1/12)1765 6
                147 1 1/2
               ──────
          2,0)191,2 7 1/2
               ──────
          £95 12 7 1/2 Ans.
          ═════════
```

```
(11) 3d. is 1/4)2147
               ──────
    1/2 is 1/6)536 9
                89 5 1/2
               ──────
          2,0)62,6 2 1/2
               ──────
           £31 6 2 1/2 Ans.
           ═════════
```

```
(12) 3d. is 1/4)7000
               ──────
    3/4 is 1/4)1750 0
                437 6
               ──────
          2,0)218,7 6
               ──────
          £109 7 6 Ans.
          ═════════
```

```
(13) 4d. is 1/3)3257
               ──────
          2,0)108,5 8
               ──────
           £54 5 8 Ans.
           ═════════
```

```
(14) 4d. is 1/3)2056
               ──────
   1/4 is 1/16) 685  4
                 42 10
               ──────
          2,0)72,8  2
               ──────
          £36 8  2 Ans.
          ═════════
```

```
(15) 4d. is 1/3)3752
               ──────
    1/2 is 1/8)1250 8
                156 4
               ──────
          2,0)140,7 0
               ──────
          £70 7 0 Ans.
          ═════════
```

```
(16) 4d. is 1/3)2107
               ──────
    1/2 is 1/8)702  4
    1/4 is 1/2) 87  9 1/2
                43 10 3/4
               ──────
          2,0)83.4  0 1/4
               ──────
          £41 14 0 1/4 Ans.
          ═════════
```

(17) 4*d.* is $\frac{1}{3}$)3210

1 is $\frac{1}{4}$)1070

267 6

2,0)133,7 6

£66 17 6 *Ans.*

(18) 4*d.* is $\frac{1}{3}$)2715

1 is $\frac{1}{4}$) 905

$\frac{1}{4}$ is $\frac{1}{4}$) 226 3

56 6$\frac{3}{4}$

2,0)118,7 9$\frac{3}{4}$

£59 7 9$\frac{3}{4}$ *Ans.*

(19) 4*d.* is $\frac{1}{3}$)3120

1 is $\frac{1}{4}$)1040

$\frac{1}{2}$ is $\frac{1}{2}$) 260

130

2,0)143,0

£71 10 0 *Ans.*

(20) 4*d.* is $\frac{1}{3}$)7521

1 is $\frac{1}{4}$)2507

$\frac{1}{2}$ is $\frac{1}{2}$) 626 9

$\frac{1}{4}$ is $\frac{1}{2}$) 313 4$\frac{1}{2}$

156 8$\frac{1}{4}$

2,0)360,3 9$\frac{3}{4}$

£180 3 9$\frac{3}{4}$ *Ans.*

(21) 6*d.* is $\frac{1}{2}$)3271

2,0)163,5 6

£81 15 6 *Ans.*

(22) 3*d.* is $\frac{1}{4}$)7914

3 ditto)1978 6

$\frac{1}{4}$ is $\frac{1}{12}$)1978 6

164 10$\frac{1}{2}$

2,0)412,1 10$\frac{1}{2}$

£206 1 10$\frac{1}{2}$ *Ans.*

(23) 6*d.* is $\frac{1}{2}$)3250

$\frac{1}{2}$ is $\frac{1}{12}$)1625

135 5

2,0)176,0 5

£88 0 5 *Ans.*

(24) 6*d.* is $\frac{1}{2}$)2708

$\frac{3}{4}$ is $\frac{1}{8}$)1354

169 3

2,0)152,3 3

£76 3 3 *Ans.*

(25) 6*d*. is $\frac{1}{2}$)3271

1 is $\frac{1}{6}$)1635 6
272 7

2,0)190,8 1

£95 8 1 *Ans.*

(26) 6*d*. is $\frac{1}{2}$)3254

1 is $\frac{1}{6}$)1627
$\frac{1}{4}$ is $\frac{1}{4}$) 271 2
67 9$\frac{1}{2}$

2,0)196,5 11$\frac{1}{2}$

£98 5 11$\frac{1}{2}$ *Ans.*

(27) 6*d*. is $\frac{1}{2}$)2701

1$\frac{1}{2}$ is $\frac{1}{4}$)1350 6
337 7$\frac{1}{2}$

2,0)168,8 1$\frac{1}{2}$

£84 8 1$\frac{1}{2}$ *Ans.*

(28) 6*d*. is $\frac{1}{2}$)3714

1$\frac{1}{2}$ is $\frac{1}{4}$)1857
$\frac{1}{4}$ is $\frac{1}{6}$) 464 3
77 4$\frac{1}{2}$

2,0)239,8 7$\frac{1}{2}$

£119 18 7$\frac{1}{2}$ *Ans.*

(29) 6*d*. is $\frac{1}{2}$)2710

2 is $\frac{1}{3}$)1355
451 8

2,0)180,6 8

£90 6 8 *Ans.*

(30) 6*d*. is $\frac{1}{2}$)3514

2 is $\frac{1}{3}$)1757
$\frac{1}{4}$ is $\frac{1}{8}$) 585 8
73 2$\frac{1}{2}$

2,0)241,5 10$\frac{1}{2}$

£120 15 10$\frac{1}{2}$ *Ans.*

(31) 6*d*. is $\frac{1}{2}$)2759

2 is $\frac{1}{3}$)1379 6
$\frac{1}{2}$ is $\frac{1}{4}$) 459 10
114 11$\frac{1}{2}$

2,0)195,4 3$\frac{1}{2}$

£97 14 3$\frac{1}{2}$ *Ans.*

(32) 6*d*. is $\frac{1}{2}$)9872

2 is $\frac{1}{3}$)4936
$\frac{1}{2}$ is $\frac{1}{4}$)1645 4
$\frac{1}{4}$ is $\frac{1}{2}$) 411 4
205 8

2,0)719,8 4

£359 18 4 *Ans.*

(33) 6*d.* is $\frac{1}{2}$)5272
3 is $\frac{1}{2}$)2636
1318
2,0)395,4
£197 14 0 *Ans.*

(34) 6*d.* is $\frac{1}{2}$)6325
3 is $\frac{1}{2}$)3162 6
$\frac{1}{4}$ is $\frac{1}{12}$)1581 3
131 9$\frac{1}{4}$
2,0)487,5 6$\frac{1}{4}$
£243 15 6$\frac{1}{4}$ *Ans.*

(35) 6*d.* is $\frac{1}{2}$)7924
3 is $\frac{1}{2}$)3962
$\frac{1}{2}$ is $\frac{1}{6}$)1981
330 2
2,0)627,3 2
£313 13 2 *Ans.*

(36) 6*d.* is $\frac{1}{2}$)2150
3 is $\frac{1}{2}$)1075
$\frac{3}{4}$ is $\frac{1}{4}$) 537 6
134 4$\frac{1}{2}$
2,0)174,6 10$\frac{1}{2}$
£87 6 10$\frac{1}{2}$ *Ans.*

(37) 6*d.* is $\frac{1}{2}$)6325
3 is $\frac{1}{2}$)3162 6
1 is $\frac{1}{3}$)1581 3
527 1
2,0)527,0 10
£263 10 10 *Ans.*

(38) 6*d.* is $\frac{1}{2}$)5724
3 is $\frac{1}{2}$)2862
1 is $\frac{1}{3}$)1431
$\frac{1}{4}$ is $\frac{1}{4}$) 477
119 3
2,0)488,9 3
£244 9 3 *Ans.*

(39) 6*d.* is $\frac{1}{2}$)6327
3 is $\frac{1}{2}$)3163 6
1 is $\frac{1}{3}$)1581 9
$\frac{1}{4}$ is $\frac{1}{4}$) 527 3
131 9$\frac{3}{4}$
2,0)540,4 3$\frac{3}{4}$
£270 4 3$\frac{3}{4}$ *Ans.*

(40) 6*d.* is $\frac{1}{2}$)3254
3 is $\frac{1}{2}$)1627
1 is $\frac{1}{3}$) 813 6
$\frac{1}{2}$ is $\frac{1}{2}$) 271 2
135 7
2,0)284,7 3
£142 7 3 *Ans.*

(41) 6*d.* is $\frac{1}{2}$)7291

3 is $\frac{1}{2}$)3645 6
$1\frac{1}{2}$ is $\frac{1}{2}$)1822 9
$\frac{1}{4}$ is $\frac{1}{8}$) 911 $4\frac{1}{2}$
151 $10\frac{3}{4}$

2,0)653,1 $6\frac{1}{4}$

£326 11 $6\frac{1}{4}$ *Ans.*

(42) 6*d.* is $\frac{1}{2}$)3256

3 is $\frac{1}{2}$)1628
2 is $\frac{1}{3}$) 814
542 8

2,0)298,4 8

£149 4 8 *Ans.*

(43) 6*d.* is $\frac{1}{2}$)7254

3 is $\frac{1}{2}$)3627
2 is $\frac{1}{3}$)1813 6
$\frac{1}{4}$ is $\frac{1}{8}$)1209 0
151 $1\frac{1}{4}$

2,0)680,0 $7\frac{1}{4}$

£340 0 $7\frac{1}{4}$ *Ans.*

(44) 6*d.* is $\frac{1}{2}$)3754

3 is $\frac{1}{2}$)1877
2 is $\frac{1}{3}$) 938 6
$\frac{1}{2}$ is $\frac{1}{4}$) 625 8
156 5

2,0)359,7 7

£179 17 7 *Ans.*

(45) 6*d.* is $\frac{1}{2}$)7972

3 is $\frac{1}{2}$)3986
2 is $\frac{1}{3}$)1993
$\frac{1}{2}$ is $\frac{1}{4}$)1328 8
$\frac{1}{4}$ is $\frac{1}{2}$) 332 2
166 1

2,0)780,5 11

£390 5 11 *Ans.*

RULE III.

(1) $\frac{1}{4}$ is $\frac{1}{48}$)2106
43 $10\frac{1}{2}$
2,0)214,9 $10\frac{1}{2}$
£107 9 $10\frac{1}{2}$ *Ans.*

(2) $\frac{1}{2}$ is $\frac{1}{24}$)3715
154 $9\frac{1}{2}$
2,0)386,9 $9\frac{1}{2}$
£193 9 $9\frac{1}{2}$ *Ans.*

(3) $\frac{3}{4}$ is $\frac{1}{16}$)2712
169 6
2,0)288,1 6
£144 1 6 *Ans.*

(4) 1*d.* is $\frac{1}{12}$)2107
175 7
2,0)228,2 7
£114 2 7 *Ans.*

(5) 1*d.* is $\frac{1}{12}$)3215
$\frac{1}{4}$ is $\frac{1}{4}$) 267 11
66 $11\frac{3}{4}$
2,0)354,9 $10\frac{3}{4}$
£177 9 $10\frac{3}{4}$ *Ans.*

(6) $1\frac{1}{2}$*d.* is $\frac{1}{8}$)2790
348 9
2,0)313,8 9
£156 18 9 *Ans.*

(7) $1\frac{1}{2}$*d.* is $\frac{1}{8}$)7904
$\frac{1}{4}$ is $\frac{1}{6}$) 988
164 8
2,0)905,6 8
£452 16 8 *Ans.*

(8) 2*d.* is $\frac{1}{6}$)3750
625
2,0)437,5
£218 15 0 *Ans.*

(9) 2*d.* is $\frac{1}{6}$)3291
$\frac{1}{4}$ is $\frac{1}{8}$) 548 6
68 $6\frac{3}{4}$
2,0)390,8 $0\frac{3}{4}$
£195 8 $0\frac{3}{4}$ *Ans.*

(10) 2*d.* is $\frac{1}{6}$)9254
$\frac{1}{2}$ is $\frac{1}{4}$)1542 4
385 7
2,0)1118,1 11
£ 559 1 11 *Ans.*

(11) $2d.$ is $\frac{1}{6}$)7250

$\frac{1}{2}$ is $\frac{1}{4}$)1208 4

$\frac{1}{4}$ is $\frac{1}{2}$) 302 1

151 0$\frac{1}{2}$

2,0)891,1 5$\frac{1}{2}$

£445 11 5$\frac{1}{2}$ *Ans.*

(12) $3d.$ is $\frac{1}{4}$)7591

1897 9

2,0)948,8 9

£474 8 9 *Ans.*

(13) $3d.$ is $\frac{1}{4}$)6325

$\frac{1}{4}$ is $\frac{1}{12}$)1581 3

131 9$\frac{1}{4}$

2,0)803,8 0$\frac{1}{4}$

£401 18 0$\frac{1}{4}$ *Ans.*

(14) $3d.$ is $\frac{1}{4}$)5271

$\frac{1}{2}$ is $\frac{1}{6}$)1317 9

219 7$\frac{1}{2}$

2,0)680,8 4$\frac{1}{2}$

£340 8 4$\frac{1}{2}$ *Ans.*

(15) $3d.$ is $\frac{1}{4}$)3254

$\frac{3}{4}$ is $\frac{1}{4}$) 813 6

203 4$\frac{1}{2}$

2,0)427,0 10$\frac{1}{2}$

£213 10 10$\frac{1}{2}$ *Ans.*

(16) $4d.$ is $\frac{1}{3}$)2915

971 8

2,0)388,6 8

£194 6 8 *Ans.*

(17) $4d.$ is $\frac{1}{3}$)3270

$\frac{1}{4}$ is $\frac{1}{16}$)1090

68 1$\frac{1}{2}$

2,0)442,8 1$\frac{1}{2}$

£221 8 1$\frac{1}{2}$ *Ans.*

(18) $4d.$ is $\frac{1}{3}$)7059

$\frac{1}{2}$ is $\frac{1}{8}$)2353

294 1$\frac{1}{2}$

2,0)970,6 1$\frac{1}{2}$

£485 6 1$\frac{1}{2}$ *Ans.*

(19) $4d$ is $\frac{1}{3}$)2750

$\frac{1}{2}$ is $\frac{1}{8}$) 916 8

$\frac{1}{4}$ is $\frac{1}{2}$) 114 7

57 3$\frac{1}{2}$

2,0)383,8 6$\frac{1}{2}$

£191 18 6$\frac{1}{2}$ *Ans.*

(20) $4d.$ is $\frac{1}{3}$)3725

1 is $\frac{1}{4}$)1241 8

310 5

2,0)527,7 1

£263 17 1 *Ans.*

(21) *4d.* is $\frac{1}{3}$)7250
1 is $\frac{1}{4}$)2416 8
$\frac{1}{4}$ is $\frac{1}{4}$) 604 2
151 0$\frac{1}{2}$
2,0)1042,1 10$\frac{1}{2}$
£521 1 10$\frac{1}{2}$ *Ans.*

(22) *4d.* is $\frac{1}{3}$)2597
1 is $\frac{1}{4}$) 865 8
$\frac{1}{2}$ is $\frac{1}{2}$) 216 5
108 2$\frac{1}{2}$
2,0)378,7 3$\frac{1}{2}$
£189 7 3$\frac{1}{2}$ *Ans.*

(23) *4d.* is $\frac{1}{3}$)7210
1 is $\frac{1}{4}$)2403 4
$\frac{1}{2}$ is $\frac{1}{2}$) 600 10
$\frac{1}{4}$ is $\frac{1}{2}$) 300 5
150 2$\frac{1}{2}$
2,0)1066,4 9$\frac{1}{2}$
£533 4 9$\frac{1}{2}$ *Ans.*

(24) *6d.* is $\frac{1}{2}$)7524
3762
2,0)1128,6
£564 6 0 *Ans.*

(25) *6d.* is $\frac{1}{2}$)7103
$\frac{1}{4}$ is $\frac{1}{24}$)3551 6
147 11$\frac{3}{4}$
2,0)1080,2 5$\frac{3}{4}$
£540 2 5$\frac{3}{4}$ *Ans.*

(26) *6d.* is $\frac{1}{2}$)3254
$\frac{1}{2}$ is $\frac{1}{12}$)1627
135 7
2,0)501,6 7
£250 16 7 *Ans.*

(27) *6d.* is $\frac{1}{2}$)7925
$\frac{3}{4}$ is $\frac{1}{8}$)3962 6
495 3$\frac{3}{4}$
2,0)1238,2 9$\frac{3}{4}$
£619 2 9$\frac{3}{4}$ *Ans.*

(28) *6d.* is $\frac{1}{2}$)9271
1 is $\frac{1}{6}$)4635 6
772 7
2,0)1467,9 1
£733 19 1 *Ans.*

(29) 6*d*. is $\frac{1}{2}$)7210
1 is $\frac{1}{6}$)3605
$\frac{1}{4}$ is $\frac{1}{4}$) 600 10
150 $2\frac{1}{2}$

2,0)1156,6 $0\frac{1}{2}$

£578 6 $0\frac{1}{2}$ *Ans.*

(30) 6*d*. is $\frac{1}{2}$)2310
$1\frac{1}{2}$ is $\frac{1}{4}$)1155
288 9

2,0)375,3 9

£187 13 9 *Ans.*

(31) 6*d*. is $\frac{1}{2}$)2504
$1\frac{1}{2}$ is $\frac{1}{4}$)1252
$\frac{1}{4}$ is $\frac{1}{6}$) 313 0
52 2

2,0)412,1 2

£206 1 2 *Ans.*

(32) 1*s*. 8*d*. is $\frac{1}{12}$)7152

£596 *Ans.*

(33) 6*d*. is $\frac{1}{2}$)2905
2 is $\frac{1}{3}$)1452 6
$\frac{1}{4}$ is $\frac{1}{8}$) 484 2
60 $6\frac{1}{4}$

2,0)490,2 $2\frac{1}{4}$

£245 2 $2\frac{1}{4}$ *Ans.*

(34) 6*d*. is $\frac{1}{2}$)7104
2 is $\frac{1}{3}$)3552
$\frac{1}{2}$ is $\frac{1}{4}$)1184
296

2,0)1213,6

£606 16 0 *Ans.*

(35) 6*d*. is $\frac{1}{2}$)1004
2 is $\frac{1}{3}$) 502
$\frac{1}{2}$ is $\frac{1}{4}$) 167 4
$\frac{1}{4}$ is $\frac{1}{2}$) 41 10
20 11

2,0)173,5 1

£86 15 1 *Ans.*

(36) 6*d*. is $\frac{1}{2}$)2104
3 is $\frac{1}{2}$)1052
526

2,0)368,2

£184 2 0 *Ans.*

(37) 6*d*. is $\frac{1}{2}$)2571
3 is $\frac{1}{2}$)1285 6
$\frac{1}{4}$ is $\frac{1}{12}$) 642 9
53 6$\frac{3}{4}$

2,0)455,2 9$\frac{3}{4}$

£227 12 9$\frac{3}{4}$ *Ans.*

(38) 6*d*. is $\frac{1}{2}$)2104
3 is $\frac{1}{2}$)1052
$\frac{1}{2}$ is $\frac{1}{6}$) 526
87 8

2,0)376,9 8

£188 9 8 *Ans.*

(39) 6*d*. is $\frac{1}{2}$)7506
3 is $\frac{1}{2}$)3753
$\frac{3}{4}$ is $\frac{1}{4}$)1876 6
469 1$\frac{1}{2}$

2,0)1360,4 7$\frac{1}{2}$

£680 4 7$\frac{1}{2}$ *Ans.*

(40) 6*d*. is $\frac{1}{2}$)1071
3 is $\frac{1}{2}$) 535 6
1 is $\frac{1}{3}$) 267 9
89 3

2,0)196,3 6

£98 3 6 *Ans.*

(41) 6*d*. is $\frac{1}{2}$)5200
3 is $\frac{1}{2}$)2600
1 is $\frac{1}{3}$)1300
$\frac{1}{4}$ is $\frac{1}{4}$) 433 4
108 4

2,0)964,1 8

£482 1 8 *Ans.*

(42) 6*d*. is $\frac{1}{2}$)2117
3 is $\frac{1}{2}$)1058 6
1$\frac{1}{2}$ is $\frac{1}{2}$) 529 3
264 7$\frac{1}{2}$

2,0)396,9 4$\frac{1}{2}$

£198 9 4$\frac{1}{2}$ *Ans.*

(43) 6*d*. is $\frac{1}{2}$)1007
3 is $\frac{1}{2}$) 503 6
1$\frac{1}{2}$ is $\frac{1}{2}$) 251 9
$\frac{1}{4}$ is $\frac{1}{6}$) 125 10$\frac{1}{2}$
20 11$\frac{3}{4}$

2,0)190,9 1$\frac{1}{4}$

£95 9 1$\frac{1}{4}$ *Ans.*

(44) 6*d*. is $\frac{1}{2}$)5000
3 is $\frac{1}{2}$)2500
2 is $\frac{1}{3}$)1250
833 4

2,0)958,3 4

£479 3 4 *Ans.*

(45) 6*d.* is $\frac{1}{2}$)2105
3 is $\frac{1}{2}$)1052 6
2 is $\frac{1}{3}$) 526 3
$\frac{1}{4}$ is $\frac{1}{8}$) 350 10
43 $10\frac{1}{4}$

2,0)407,8 $5\frac{1}{4}$

£203 18 $5\frac{1}{4}$ *Ans.*

(46) 6*d.* is $\frac{1}{2}$)1006
3 is $\frac{1}{2}$) 503
2 is $\frac{1}{3}$) 251 6
$\frac{1}{2}$ is $\frac{1}{4}$) 167 8
41 11

2,0)197,8 1

£98 10 1 *Ans.*

(47) 6*d.* is $\frac{1}{2}$)2705
3 is $\frac{1}{2}$)1352 6
2 is $\frac{1}{3}$) 676 3
$\frac{3}{4}$ is $\frac{1}{4}$) 450 10
169 $0\frac{3}{4}$

2,0)535,3 $7\frac{3}{4}$

£267 13 $7\frac{3}{4}$ *Ans.*

(48) 6*d.* is $\frac{1}{2}$)5000
3 is $\frac{1}{2}$)2500
2 is $\frac{1}{3}$)1250
$\frac{1}{2}$ is $\frac{1}{4}$) 833 4
208 4

2,0)979,1 8

£489 11 8 *Ans.*

(49) 6*d.* is $\frac{1}{2}$)4000
3 is $\frac{1}{2}$)2000
2 is $\frac{1}{3}$)1000
$\frac{3}{4}$ is $\frac{1}{4}$) 666 8
250 0

2,0)791,6 8

£395 16 8 *Ans.*

RULE IV.

(1) 2750
1

£275 0 0 *Ans.*

(2) 3254
2

£650 16 0 *Ans.*

(3) 2710
3

£813 0 0 *Ans.*

(4) 1572
4
£628 16 0 *Ans.*

(5) 2102
5
£1051 0 0 *Ans.*

(6) 2101
6
£1260 12 0 *Ans.*

(7) 5271
7
£3689 14 0 *Ans.*

(8) 3123
8
£2498 8 0 *Ans.*

(9) 1075
8
£860 0 0 *Ans.*

(10) 1621
9
£1458 18 0 *Ans.*

RULE V.

(1) 2,0)270,3
£135 3 0 *Ans.*

(2) 2715
7
2,0)1900,5
Ans. £950 5 0

(3) 2150
15
2,0)3225,0
£16 2 10 0 *Ans.*

(4) 3270
3
2,0)981,0
£490 10 0 *Ans.*

(5) 3271
5
2,0)1635,5
£817 15 0 *Ans.*

(6) 3214
9
2,0)2892,6
£1446 6 0 *Ans.*

(7) 2710
11
2,0)2981,0
£1490 10 0 *Ans.*

(8) 3179
13
2,0)4132,7
£2066 7 *Ans.*

(9) 3142
17
2,0)5341,4
£2670 14 0 *Ans.*

(10)
```
      2150
        19
    ------
     19350
     2150
    ------
2,0)4085,0
---------------
£2042 10 0 Ans.
```

(11)
```
      7157
        19
    ------
2,0)13598,3
--------------
£6799 3 0 Ans.
```

RULE VI.

(1) 6*s*. 8*d*. is $\frac{1}{3}$)2710

£903 6 8 *Ans.*

(2) 3*s*. 4*d*. is $\frac{1}{6}$)3150

£525 0 0 *Ans.*

(3) 2*s*. 6*d*. is $\frac{1}{8}$)2715

£339 7 6 *Ans.*

(4) 12 / 7150 at 1*s*. 8*d*.

£595 16 8 *Ans.*

(5) 1*s*. 4*d*. is $\frac{1}{15}$)3215

£214 6 8 *Ans.*

(6) 1*s*. 3*d*. is $\frac{1}{16}$)7211

£450 13 9 *Ans.*

(7) 2*s*. is $\frac{1}{10}$)2710

1*s*. is $\frac{1}{2}$)	271	0	0
2*d*. is $\frac{1}{6}$)	135	10	0
	22	11	8
	£429	1	8 *Ans.*

(8) 4*s*. is $\frac{1}{5}$)7514

6*d*. is $\frac{1}{8}$)	1502	16	0
1 is $\frac{1}{6}$)	187	17	0
	31	6	2
	£1721	19	2 *Ans.*

(9) 4*s*. is $\frac{1}{5}$)2517

1 is $\frac{1}{4}$)	503	8	0
3*d*. is $\frac{1}{4}$)	125	17	0
	31	9	3
	£660	14	3 *Ans.*

(10) 4*s*. is $\frac{1}{5}$)2547

2 is $\frac{1}{2}$)	509	8	0
1 is $\frac{1}{2}$)	254	14	0
3*d*. is $\frac{1}{4}$)	127	7	0
$\frac{1}{2}$ is $\frac{1}{6}$)	31	16	9
	5	6	$1\frac{1}{2}$
	£928	11	$10\frac{1}{2}$ *Ans.*

(11) 5*s*. is $\frac{1}{4}$)3271

6*d*. is $\frac{1}{10}$)	817	15	0
3*d*. is $\frac{1}{2}$)	81	15	6
$\frac{1}{4}$ is $\frac{1}{12}$)	40	17	9
	3	8	$1\frac{3}{4}$
	£943	16	$4\frac{3}{4}$ *Ans.*

(12) 10*s*. is $\frac{1}{2}$)2103

5*s*. is $\frac{1}{2}$)	1051	10	0
3*d*. is $\frac{1}{20}$)	525	15	0
$1\frac{1}{2}$ is $\frac{1}{2}$)	26	5	9
	13	2	$10\frac{1}{2}$
	£1616	13	$7\frac{1}{2}$ *Ans.*

(13) 10*s*. is $\frac{1}{2}$)7152

5*s*. is $\frac{1}{2}$)	3576	0	0
2*s*. is $\frac{1}{5}$)	1788	0	0
6*d*. is $\frac{1}{4}$)	715	4	0
$\frac{3}{4}$ is $\frac{1}{8}$)	178	16	0
	22	7	6
	£6280	7	0 *Ans.*

(14) 10*s*. is $\frac{1}{2}$)2510

4*s*. is $\frac{1}{5}$)	1255	0	0
6*d*. is $\frac{1}{8}$)	502	0	0
1*d*. is $\frac{1}{6}$)	62	15	0
$\frac{1}{4}$ is $\frac{1}{4}$)	10	9	2
	2	12	$3\frac{1}{2}$
	£1832	16	$5\frac{1}{2}$ *Ans.*

(15) 3715

	3715		
	9		
	33435		
4*d*. is $\frac{1}{3}$)	1238	4	
$\frac{1}{2}$ is $\frac{1}{8}$)	154	$9\frac{1}{2}$	
	2,0)3482,8	$1\frac{1}{2}$	
	£1741	8	$1\frac{1}{2}$ *Ans.*

(16) 6*d*. is $\frac{1}{2}$)2572

	2572		
	13		
$1\frac{1}{2}$ is $\frac{1}{4}$)	33436		
	1286		
	321	6	
	2,0)3504,3	6	
	£1752	3	6 *Ans.*

(17) 6*d*. is $\frac{1}{2}$)7251
14

101514
2*d*. is $\frac{1}{3}$) 3625 6
$\frac{1}{4}$ is $\frac{1}{8}$) 1208 6
151 0$\frac{3}{4}$

2,0)10649,9 0$\frac{3}{4}$

£5324 19 0$\frac{3}{4}$ *Ans.*

(18) 6*d*. is $\frac{1}{2}$)3210
15

48150
1$\frac{1}{2}$*d*. is $\frac{1}{4}$) 1605
$\frac{1}{4}$ is $\frac{1}{6}$) 401 3
66 10$\frac{1}{2}$

2,0)5022,3 1$\frac{1}{2}$

£2511 3 1$\frac{1}{2}$ *Ans.*

(19) 2*d*. is $\frac{1}{6}$)2710
19

51490
$\frac{1}{2}$ is $\frac{1}{4}$) 451 8
112 11

2,0)5205,4 7

£2602 14 7 *Ans.*

In the solution of some of the preceding questions, I have deviated from the author's rule.

RULE VII.

(1) 4*s*. is $\frac{1}{5}$)7215
7

50505
1443

£51948 *Ans.*

(2) 2*s*. 6*d*. is $\frac{1}{8}$)2104
5

10520
6*d*. is $\frac{1}{5}$) 263
52 12

£10835 12 0 *Ans.*

(3) 4*s*. is $\frac{1}{5}$)2107
2

4214
421 8
4*s*. ditto 421 8

£5056 16 0 *Ans.*

(4) 5*s*. is $\frac{1}{4}$)7156
5

1*s*. is $\frac{1}{5}$)35780
1789
357 16

£37926 16 0 *Ans.*

(5) 6*d*. is $\frac{1}{2}$)2710
43 shill.

116530
1$\frac{1}{2}$*d*. is $\frac{1}{4}$) 1355
338 9

2,0)11822,3 9

£5911 3 9 *Ans.*

(6) 10*s*. is $\frac{1}{2}$)3215
5*s*. is $\frac{1}{2}$)1607 10
2*s*. is $\frac{1}{5}$) 803 15
321 10

£5947 15 0 *Ans.*

(7) 10*s*. is $\frac{1}{2}$)2107
2*s*. is $\frac{1}{5}$)1053 10
1*s*. is $\frac{1}{2}$) 210 14
105 7

£3476 11 0 *Ans.*

(8) 6*s*. 8*d*. is $\frac{1}{3}$)3215
4

12860
1071 13 4

£13931 13 4 *Ans.*

(9) 1*s*. 3*d*. is $\frac{1}{16}$)2154
7

15078
134 12 6

£15212 12 6 *Ans.*

(10) 3*s*. 4*d*. is $\frac{1}{6}$)2701
2

5402
450 3 4

£5852 3 4 *Ans.*

(11)

	£	s.	d.
10s. is $\frac{1}{2}$)	2715		
5s. is $\frac{1}{2}$)	1357	10	
2s. is $\frac{1}{5}$)	678	15	
2d. is $\frac{1}{12}$)	271	10	
$\frac{1}{2}$ is $\frac{1}{4}$)	22	12	6
	5	13	$1\frac{1}{2}$
Ans.	£5051	0	$7\frac{1}{2}$

(12)

	£	s.	d.
10s. is $\frac{1}{2}$)	2157		
	3		
	6471		
5s. is $\frac{1}{2}$)	1078	10	
2d. is $\frac{1}{30}$)	539	5	
$\frac{1}{4}$ is $\frac{1}{8}$)	17	19	6
	2	4	$11\frac{1}{4}$
Ans.	£8108	19	$5\frac{1}{4}$

(13)

	£	s.	d.
10s. is $\frac{1}{2}$)	3210		
5s. is $\frac{1}{2}$)	1605		
2s. 6d. is $\frac{1}{2}$)	802	10	
10d. is $\frac{1}{3}$)	401	5	
$2\frac{1}{2}$d. is $\frac{1}{4}$)	133	15	
$\frac{1}{4}$ is $\frac{1}{10}$)	33	8	9
	3	6	$10\frac{1}{2}$
	£6189	5	$7\frac{1}{2}$ *Ans.*

(14)

	£	s.	d.
5s. is $\frac{1}{4}$)	2157		
	2		
2s. is $\frac{1}{10}$)	4314		
	539	5	
4d. is $\frac{1}{6}$)	215	14	
$\frac{1}{2}$ is $\frac{1}{8}$)	35	19	
	4	9	$10\frac{1}{2}$
	£5109	7	$10\frac{1}{2}$ *Ans.*

(15)

	£	s.	d.
10s. is $\frac{1}{2}$)	142		
5s. is $\frac{1}{2}$)	71		
2d. is $\frac{1}{30}$)	35	10	
$\frac{1}{2}$ is $\frac{1}{4}$)	1	3	8
$\frac{1}{4}$ is $\frac{1}{2}$)	0	5	11
	0	2	$11\frac{1}{2}$
Ans.	£250	2	$6\frac{1}{2}$

(16)

	£	s.	d.
10s. is $\frac{1}{2}$)	95		
	15		
	1425		
4s. is $\frac{1}{5}$)	47	10	
6d. is $\frac{1}{8}$)	19	0	
1d. is $\frac{1}{6}$)	2	7	6
$\frac{1}{4}$ is $\frac{1}{4}$)	0	7	11
	0	1	$11\frac{3}{4}$
Ans.	£1494	7	$4\frac{3}{4}$

(17)

	£	s.	d.
10*s*. is ½)	37		
5*s*. is ½)	18	10	
4*s*. is ⅕)	9	5	
4*d*. is $\frac{1}{12}$)	7	8	
1 is ¼)	0	12	4
½ is ½)	0	3	1
¼ is ½)	0	1	6½
	0	0	9¼
Ans.	£73	0	8¾

(18)

	£	s.	d.
10*s*. is ½)	2175		
	2		
	4350		
5*s*. is ½)	1087	10	
4*d*. is $\frac{1}{15}$)	543	15	
½ is ⅛)	36	5	
	4	10	7½
Ans.	£6022	0	7½

(19)

	£	s.	d.
10*s*. is ½)	2150		
	17		
	36550		
5*s*. is ½)	1075		
1*s*. is ⅕)	537	10	
1½*d*. is ⅛)	107	10	
	13	8	9
	£38283	8	9 *Ans.*

RULE VIII.

(1)

qrs.	£.	*s.*	*d.*
2 is ½)	3	17	6
			5 × 5 = 25
	19	7	6
			5
	96	17	6
14*lb*. is ¼)	1	18	9
	0	9	8¼
	£99	5	11¼ *Ans.*

(2)

qr.	£.	*s.*	*d.*
1 is ¼)	1	4	9
			4 × 4 + 1 = 17
	4	19	0
			4
	19	16	0
	1	4	9
14*lb*. is ½)	0	6	2¼
2*lb*. is $\frac{1}{7}$)	0	3	1
1*lb*. is ½)	0	0	5¼
	0	0	2½
	£21	10	8 *Ans.*

qr.	£.	s.	d.
(3) 1 is $\frac{1}{4}$)	1	7	8
			$12\times7+1$
	16	12	0
			7
	116	4	0
	1	7	8
8*lb.* is $\frac{1}{14}$)	0	6	11
2*lb.* is $\frac{1}{4}$)	0	1	$11\frac{3}{4}$
	0	0	$5\frac{3}{4}$
	£118	1	$0\frac{1}{2}$ *Ans.*

lb.	£.	s.	d.
(4) 16 is $\frac{1}{7}$)	4	5	8
1 *qr.* is $\frac{1}{4}$)			$12\times6=72$
	51	8	0
			6
	308	8	0
	1	1	5
2*lb.* is $\frac{1}{8}$)	0	12	$2\frac{3}{4}$
	0	1	$6\frac{1}{4}$
	£310	3	2 *Ans.*

qrs.	£.	s.	d.
(5) 2 is $\frac{1}{2}$)	1	1	4
			$9\times3=27$
	9	12	0
			3
	28	16	0
14*lb.* is $\frac{1}{4}$)	0	10	8
$1\frac{1}{14}$ is $\frac{1}{14}$)	0	2	8
	0	0	$2\frac{1}{4}$
	£29	9	$6\frac{1}{4}$ *Ans.*

qrs.	£.	s.	d.
(6) 2 is $\frac{1}{2}$)	2	17	9
			$6\times12+6=78$
	17	6	6
			12
	207	18	0
	17	6	6
1*qr.* is $\frac{1}{2}$)	1	8	$10\frac{1}{2}$
8*lb.* is $\frac{1}{7}$ of 2*q.*)	0	14	$5\frac{1}{4}$
4*lb.* is $\frac{1}{2}$)	0	4	$1\frac{1}{2}$
	0	2	$0\frac{3}{4}$
	£227	14	0 *Ans.*

	qr.	£.	s.	d.
(7)	1 is $\frac{1}{4}$)	2	15	9
				$8\times7=56$
		22	6	0
				7
		156	2	0
	14*lb.* is $\frac{1}{2}$)	0	13	$11\frac{1}{4}$
	2*lb.* is $\frac{1}{7}$)	0	6	$11\frac{1}{2}$
	1*lb.* is $\frac{1}{2}$)	0	0	$11\frac{3}{4}$
		0	0	$5\frac{3}{4}$
		£157	4	$4\frac{1}{4}$ *Ans.*

	lb.	£.	s.	d.
(8)	14 is $\frac{1}{8}$)	3	17	10
				8
		31	2	8
				12
		373	12	0
		3	17	10
	1*lb.* is $\frac{1}{14}$)	0	9	$8\frac{3}{4}$
		0	0	$8\frac{1}{4}$
		£378	0	3 *Ans.*

	qrs.	£.	s.	d.
(9)	2 is $\frac{1}{2}$)	4	14	6
				$6\times6+1=37$
		28	7	0
				6
		170	2	0
		4	14	6
	8*lb.* is $\frac{1}{7}$)	2	7	3
	4*lb.* is $\frac{1}{2}$)	0	6	9
	1*lb.* is $\frac{1}{4}$)	0	3	$4\frac{1}{2}$
		0	0	10
		£177	14	$8\frac{1}{2}$ *Ans.*

	qr.	£.	s.	d.
(10)	1 is $\frac{1}{4}$)	3	14	6
				$5\times3=15$
		18	12	6
				3
		55	17	6
	8*lb.* is $\frac{1}{14}$)	0	18	$7\frac{1}{2}$
	2*lb.* is $\frac{1}{4}$)	0	5	$3\frac{3}{4}$
		0	1	$3\frac{3}{4}$
		£57	2	9 *Ans.*

	qrs.	*£.*	*s.*	*d.*
(11)	2 is $\frac{1}{2}$)	4	15	4

$$12\times7\times2+4=172$$

	£.	s.	d.
	57	4	0
			7
	400	8	0
			2
	800	16	0
	19	1	4
1*qr.* is $\frac{1}{2}$)	2	7	8
8*lb.* is $\frac{1}{7}$)	1	3	10
4*lb.* is $\frac{1}{2}$)	0	6	$9\frac{1}{2}$
	0	3	$4\frac{3}{4}$
	£823	19	$0\frac{1}{4}$ *Ans.*

	lbs.	*£.*	*s.*	*d.*
(12)	16 is $\frac{1}{7}$)	3	11	6

$$10\times5+3=53$$

	£.	s.	d.
	35	15	0
			5
	178	15	0
	10	14	6
1*lb.* is $\frac{1}{16}$)	0	10	$2\frac{1}{2}$
	0	0	$7\frac{1}{2}$
	£190	0	4 *Ans.*

TARE, TRET, AND CLOFF.

RULE I.

	cwt.	*qrs.*	*lbs.*		*lbs.*
(1)	5	2	5		23
			7		7
	38	3	7	gross	161 = 1*cwt.* 1*qr.* 21*lb.*
subtract	1	1	21	tare	
Ans.	37	1	14	neat.	

	cwt.	*qrs.*	*lbs.*	
(2)	163	2	15	gross
	22	1	8	tare
Ans.	141	1	7	neat.

lbs.	*cwt.*	*qrs.*	*lbs.*
100 =	0	3	16
25 =	5	×	5
	4	1	24
			5
	22	1	8

	lbs.	*oz.*		*lbs.*	*oz.*
(3)	85	4		3	5
		4 × 4 = 16			4 × 4 = 16
	341			13	4
	4				4
	1364	gross		53	0
	53	tare			
Ans.	1311	pounds neat.			

RULE II.

(1)

	cwt.	qr.	lbs.	
	75	1	14	gross
	6	2	24	tare
Ans.	68	2	18	neat

lbs. cwt.
112)752 (6
672

28)80 (2qrs.
56

24

(2)

	cwt.	qrs.	lbs.	
	0	2	27	
				8 × 9 + 3 = 75
	5	3	20	
			9	
	53	1	12	
	2	0	25	
	55	2	9	gross
	5	1	9	tare
Ans.	50	1	0	

lbs. $\frac{4}{(21}$
28)597 (21
56 —— 5 1

37
28

9

RULE III.

(1)

	cwt.	qrs.	lbs.	
	8	2	5	
				6 × 3 = 18
	51	1	2	
			3	
14*lb.* is $\frac{1}{8}$)	153	3	6	gross.
	19	0	$25\frac{1}{4}$	tare
Ans.	134	2	$8\frac{3}{4}$	

(2)

	cwt.	qrs.	lbs.	
	2	1	0	
				5 × 5 = 25
	11	1	0	
			5	
16*lb.* is $\frac{1}{7}$)	56	1	0	gross
	8	0	4	tare
Ans.	48	0	24	neat.

	cwt.	qrs.	lbs.	
(3)	8	3	14	
			9	
16*lbs.* is $\frac{1}{7}$)	79	3	14	gross
	11	1	18	tare
Ans.	68	1	24	neat.

RULE IV.

	cwt.	qrs.	lbs.	
(1)	12	2	24	
			4	
			50	
			28	
14*lbs.* is $\frac{1}{8}$)			1424	gross
			178	tare
26)			1246	suttle
			47	tare
Ans.			1199	pounds.

	cwt.	qrs.	lbs.	
(2)	7	3	27	
	4			
	31			
	28			
	895			gross
	36			tare
26)	859			suttle
	33			tret
Ans.	826			pounds.

	cwt.	qrs.	lbs.	
(3) 8*lb.* is $\frac{1}{14}$)	152	1	3	gross
2*lb.* is $\frac{1}{4}$)	10	3	14	
	2	2	$24\frac{1}{2}$	
	13	2	$10\frac{1}{2}$	tare
26)	138	2	$20\frac{1}{2}$	suttle
	5	1	$9\frac{1}{2}$	tret nearly
Ans.	133	1	11	neat.

RULE V.

```
                    cwt.qrs.lbs.                  cwt.
(1) 7lb. is 1/16)15    3  20 gross              14¼ suttle
                  0    3  27½ tare               2
                 ____________                  ______
             26)14    3  20½ suttle           3)28½
                  0    2   8  tret             ______
                 ____________                     9½
                 14    1  12½ suttle           ______
                           9½ cloff
                 ____________
           Ans.  14    1   3 neat.
                 ============

            cwt.qrs.lbs.                          cwt.
     (2)    5   2   7                             34¾
                    7                              2
            ____________                        ______
8lb. is 1/14)38   3  21 gross                   3)69½
              2   3   3½ tare                   ______
            ____________                          23
        26)36   0  17½ suttle                   ______
            1   1  15½ tret
            ____________
           34   3   2 suttle
               23 cloff
            ____________
      Ans. 34   2   7 neat.
           ============
```

SIMPLE INTEREST.

£.

(1) 2,0)375 × 5 ÷ 100 = 1/20

Ans. 18 15 0

This is done by dividing by 20, because 5 is 1/20 of a 100; the same may any other question be done when the rate per cent. is an aliquot part of a hundred.

	£.	£.
(2)	4 is $\frac{1}{25}$)	268
	Ans.	10 14 $4\frac{3}{4}\frac{1}{5}$

	£.	s.
(3)	945	10
		4
	37)82	0
	20	
	16)40	
	12	
	4)80	
	4	
	3)20	

	£.	s.	d.
Or thus, £4. is $\frac{1}{25}$)	945	10	
Ans.	37	16	$4\frac{3}{4}$

	£.	s.	d.
(4)	547	15	0
			5
	27)38	15	0
	20		
	7)75		
	12		
	9)00		

£.	s.	d.	
27	7	9	
		3	
82	3	3	*Ans.*

	£.	s.	d.
(5) 4 is $\frac{1}{25}$)	254	17	6
Or $4 \div 100 \times 5 = \frac{1}{5}$)	50	19	6 *Ans.*

		£.	s.	d.	
(6)	$\frac{1}{4}$)	556	13	4	
					$5 \times 5 \div 100 = \frac{1}{4}$
Ans.		139	3	4	

		£.	s.	
(7)	£$2\frac{1}{2}$ is $\frac{1}{40}$)	754	16	
	Ans.	18	17	$4\frac{3}{4}\ \frac{1}{5}$.

		£.	s.	d.
(8)		876	5	10
				$3\frac{3}{4}$
		2628	17	6
		438	2	11
		219	1	$5\frac{1}{2}$
	32)	86	1	$10\frac{1}{2}$
		20		
	17)	21		
		12		
	2)	62		
		4		
	2)	50		

Ans. £32. 17*s.* $2\frac{1}{4}$*d.*

PURCHASING STOCKS.

```
                      £.    s.  d.
                (9) 2054   16   0
110¼=11×10+¼                   10
                   ----------------
                   20548    0   0
                               11
                   ----------------
                  226028    0   0
                     513   14   0
                   ----------------
               2265)41     14   0
                           20
                          ----
                          8)34
                            12
                          ----
                          4)08
                          ====
                          £2265. 8s. 4d. Ans.
```

```
      £.    s.  d.
(10) 1797  14   0
                4⅜
     ------------
     7190  16   0
      449   8   6 for 2/8
      224  14   3 for 1/8
     ------------
  78)64    18   9
           20
          ----
        12)98
           12
          ----
        11)85
            4
          ----
         3)40
          ----
```

	£.	s.	d.	
To	78	12	11¾	
Add	1797	14	0	for 100
	£1876	6	11¾	*Ans.*

```
      £.  s.  d.
(11)  577 19  0
              ‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾
              8×12+¾=96¾
     ------------
     4623 12  0
             12
     ------------
    55483  4  0
      288 19  6
      144  9  9
     ------------
 559) 16 13  3
      20
     ----
   3) 33
      12
     ----
   3) 99
       4
     ----
   3) 96
     ====
```

Ans. £559. 3*s*. 3¾*d*.

```
                         £.  s.  d.
                  (12)  758 17 10
124⅝ = 10×12+4⅝              10
                       -----------
                       7588 18  4
                               12
                       -----------
                      91067  0  0
                       3035 11  4
                        379  8 11  for 4/8
                         94 17  2¾ for 1/8
                       -----------
                   945) 76 17  5¾
                        20
                       ----
                    15) 37
                        12
                       ----
                     4) 49
                         4
                       ----
                     1) 99
                       ====
```

Ans. £945. 15*s*. 4¼*d*.

BROKAGE.

	£.	s.	d.		£.	s.	d.
(13)	25) 75	17	6	4*s.* is $\frac{1}{5}$)	25	15	2
	20						
	15) 17				5	3	$0\frac{1}{4}$ *Ans.*
	12						
	2) 10						

	£.	s.	d.		£.	s.	d.
(14)	71) 05	5	10	5*s.* is $\frac{1}{4}$)	71	1	$0\frac{1}{2}$
	20						
	1) 05			6*d.* is $\frac{1}{10}$)	17	15	3
	12				1	15	$6\frac{1}{4}$
	0) 70				19	10	$9\frac{1}{4}$ *Ans.*
	4						
	2) 80						

	£.	s.	d.		£.	s.	d.
(15)	9) 75	6	4	5*s.* is $\frac{1}{4}$)	9	15	$0\frac{3}{4}$
	20						
	15) 06			1*s.* is $\frac{1}{5}$)	2	8	9
	12			6*d.* is $\frac{1}{2}$)	0	9	9
					0	4	$10\frac{1}{2}$
	0) 76				3	3	$4\frac{1}{2}$ *Ans.*
	4						
	3) 04						

	£.	s.	d.
(16)	547	2	4
			4
21)	88	9	4
	20		
17)	69		
	12		
8)	32		
	4		
1)	28		

£.	s.	d.	
21	17	$8\frac{1}{4}$	interest for a year.
		$5\frac{1}{2}$	years.
109	8	$3\frac{1}{4}$	
10	18	10	
Ans. 120	7	$3\frac{1}{4}$	

	£.	s.	d.
(17)	257	5	1
			4
10)	29	0	4
	20		
5)	80		
	12		
9)	64		
	4		
2)	56		

£.	s.	d.	
10	5	$9\frac{1}{2}$	interest for a year.
5	2	$10\frac{3}{4}$	for half.
2	11	$5\frac{1}{4}$	
18	0	$1\frac{1}{2}$	*Ans.*

	£.	s.	d.	
(18) £5. is $\frac{1}{20}$)	479	5	0	
	23	19	3	
			$5\frac{1}{4}$	years.
	119	16	3	
	5	19	$9\frac{3}{4}$	
	125	16	$0\frac{3}{4}$	*Ans.*

	£.	s.	d.
(19)	576	2	7
			$4\frac{1}{2}$
	2305	10	4
	288	1	$3\frac{1}{2}$
25)	93	11	$7\frac{1}{2}$
	20		
18)	71		
	12		
8)	59		
	4		
2)	38		

£.	s.	d.	
25	18	$8\frac{1}{2}$	
		$7\frac{1}{4}$	
181	10	$11\frac{1}{2}$	
6	9	8	
187	19	$7\frac{1}{2}$	*Ans.*

	£.	s.	d.
(20)	279	13	8
			$5\frac{1}{4}$
	1398	8	4
	69	18	5
14)	68	6	9
	20		
13)	66		
	12		
8)	01		

£.	s.	d.	
14	13	8	
		$3\frac{1}{2}$	
44	1	0	
7	6	10	
51	7	10	*Ans.*

To find the Interest for any Number of Weeks.

```
                     £.  s.  d.
(21)  £5. is 1/20)259  13   5
                   -----------
                    12  19   8 interest for one year.
                   -----------

      weeks £.  s.  d. weeks
If 52 : 12  19  8 : : 20
                5      5
         -------------
Or 13) 64  18   4
       -----------
        4  19  10¼ Ans.
       ===========
```

```
      £.   s.  d.
(22) 375   6   1
               4½
     ------------
    1501   4   4
     187  13   0½
     ------------
16)  88  17   4½
     20
    ---
17) 77
    12
    ---
 9) 28
     4
    ---
 1) 14
    ---
```

```
      wks. £.  s.  d.   wks.
If 52 : 16  17  9¼ : : 12
                3       3
        --------------
Or 13)  50  13  3¾
        ----------
         3  17  11¼
        ----------
```

	£.	s.	d.	
Principal	375	6	1	
Interest add	3	17	11¼	
Amount	379	4	0¼	*Ans.*

To find the Interest for any Number of Days.

	£.	s.	d.
(23)	985	2	7
			$5\frac{1}{2}$
	4925	12	11
	492	11	$3\frac{1}{2}$
54)	18	4	$2\frac{1}{2}$
	20		
3)	64		
	12		
7)	70		
	4		
2)	82		

If 365 days : $\underline{54l.\ 3s.}\ 7\frac{1}{2}d.$: : 127 days :

$$\frac{54l.\ 3s.\ 7\frac{1}{2}d. \times \overline{10 \times 12+7}}{365} = \frac{6881l.\ 0s\ 4\frac{1}{2}d.}{365} =$$

$18l.\ 17s.\ 0\frac{1}{2}d.$ interest for 127 days, this added to $54l.\ 3s.\ 7\frac{1}{2}d.$ 82×5 years$=270l.\ 18s.\ 2\frac{1}{2}d.$ gives $289l.\ 15s.\ 3d.$ *Ans.*

	£.	s.	d.
(24)	2726	1	4
			$4\frac{1}{2}$
	10904	5	4
	1363	0	8
	122) 67	6	0
	20		
	13) 46		
	12		
	5) 52		
	4		
	2) 08		

If 365 days : 122*l.* 13*s.* $5\frac{1}{2}$*d.* : : 154 days :

$$\frac{122l.\ 13s.\ 5\tfrac{1}{2}d. \times \overline{12 \times 12 + 10}}{365} = 51l.\ 15s.\ 1\tfrac{3}{4}d.$$ interest

for 154 days, which added to 122*l.* 13*s.* $5\frac{1}{2}$*d.* × 3 = 368*l.* 0*s.* $4\frac{1}{2}$*d.* gives 419*l.* 15*s.* $6\frac{1}{4}$*d.* *Ans.*

How to find the Principal, by having the Amount, Time, and Rate per Cent. given.

(25) First, $£\overline{3 \times 5} + £100 = £115$. As £115 : £100 : : 402*l.* 10*s.* : $\frac{402l.\ 10s. \times 100}{115} = \frac{£40250}{115} = \frac{8050}{23} =$ £350. *Ans.*

(26) First, $\overline{£4\times9}+100=£136$ amount of £100. for the given time. As £136. : £100. : : £734. 8s. : $\frac{73440}{136}=\frac{9180}{17}=£540$. *Ans.*

(27) First, $£5\times7+100=£135$. As £135 : £100 : : $\frac{334l.\ 16s.\times100}{135}=\frac{33480}{27\times5}=\frac{2232}{9}=£248$. *Ans.*

How to find the Time, by having the Principal, Rate per Cent. and Amount given.

(28) First, $\overline{£350\times3}\div100=1050\div100=£10.\ 10s.$ interest of the principal for one year. £402. 10s.—£350 =52l. 10s. whole interest. If £10. 10s. : 1 year : : £52. 10s. : $\frac{52\frac{1}{2}}{10\frac{1}{2}}=\frac{105}{21}=5$ years, *Ans.*

(29) First, $£540\times4\div100=2160\div100=21l.\ 12s.$ interest for one year. £734. 8s.—£540=194l. 8s. whole interest. If 21l. 12s. : 1 year : : 194l. 8s. : $\frac{3888}{432}=\frac{486}{54}=\frac{54}{6}=9$ years, *Ans.*

(30) First, $£248\times5\div100=\frac{248}{20}=12l.\ 8s.$ interest for one year. £334. 16s.—£248=£86. 16s. If £12. 8s. : 1 year : : £86. 16s. : $\frac{1736}{248}=\frac{217}{31}=7$ years, *Ans.*

How to find the Rate per Cent. by having the principal Amount and Time given.

(31) First, £402. 10s.—£350=£52. 10s. interest for the whole time. As £350 : £52. 10s. : : £100. : $\frac{5250}{350}=\frac{525}{35}=\frac{105}{7}=15$. $15\div5=3$ rate per cent. *Ans.*

(32) First, 334*l.* 16*s.*—£248=£86. 16*s.* interest for the whole time. As £248. : 86*l.* 16*s.* : : £100. : $\frac{8680}{248}$ $=\frac{1085}{31}$=35 interest. 35÷7=5 per cent. *Ans.*

(33) First, 734*l.* 8*s.*—£540=194*l.* 8*s.* As £540. : 194*l.* 8*s.* : : £100, : $\frac{1944}{540}=\frac{324}{90}$=36 interest. 36÷9 = 4 per cent. *Ans.*

COMPOUND INTEREST.

	£.	£.			
(1)	5 is $\frac{1}{20}$)	500			first year's principal.
		25			interest add.
	$\frac{1}{20}$)	525			second year's principal.
		26	5		interest add.
	$\frac{1}{20}$)	551	5		third year's principal.
		27	11	3	interest add.
		578	16	3	amount.
	Subtract	500	0	0	first year's principal.
	Ans.	78	16	3	interest for three years.

£.
(2) 400
6

100) 24) 00

424 0 0
25 8 $9\frac{1}{2}$ interest.

449 8 $9\frac{1}{2}$ principal.
6

100) 26) 96 12 9
20

19) 32
12

3) 93
4

3) 72

	£.	s.	d.	
	476	8	$1\frac{1}{4}$	
Add	14	5	10	
Ans.	490	13	$11\frac{1}{4}$	amount.

£.
400 principal.
24 interest.

424
6

100) 25) 44
20

8) 80
12

9) 60
4

2) 40

	£.	s.	d.
principal	449	8	$9\frac{1}{2}$
interest	26	19	$3\frac{3}{4}$
	476	8	$1\frac{1}{4}$
half the rate =			3

14) 29 4 $3\frac{3}{4}$
20

5) 84
12

10) 11
4

-) 47

	£.	s.	d.	
(3) £5 is $\frac{1}{20}$)	650			principal.
	32	10		interest.
$\frac{1}{20}$)	682	10		principal for two years.
	34	2	6	interest.
$\frac{1}{20}$)	716	12	6	principal for three years.
	35	16	$7\frac{1}{2}$	interest.
$\frac{1}{20}$)	752	9	$1\frac{1}{2}$	principal for four years.
	37	12	$5\frac{1}{4}$	interest.
$\frac{1}{20}$)	790	1	$6\frac{3}{4}$	principal for five years.
	39	10	$0\frac{3}{4}$	interest.
Ans.	829	11	$7\frac{1}{2}$	amount required.

	£.	s.	
(4)	550	10	
		6	
	33)03	0	
		20	
		0)60	
		12	
		7)20	

£.	s.	d.	
550	10	0	principal.
33	0	7	interest.
583	10	7	principal for two years.
		6	
35)01	3	6	
20			
0)23			
12			
2)82			
4			
3)28			

£.	s.	d.	
583	10	7	
35	0	$2\frac{3}{4}$	
618	10	$9\frac{3}{4}$	principal for 3.
		6	
37)11	4	$10\frac{1}{2}$	
20			
2)24			
12			
2)98			
4			
3)94			

£.	s.	d.	
618	10	$9\frac{3}{4}$	principal.
37	2	$2\frac{3}{4}$	interest.
655	13	$0\frac{1}{2}$	fourth year's principal.
		3	=half rate.
19) 66	19	$1\frac{1}{2}$	
20			
13) 39			
12			
4) 69			
4			
2)78			

	£.	s.	d.	
	655	13	$0\frac{1}{2}$	principal.
	19	13	$4\frac{1}{2}$	interest.
Ans.	675	6	5	amount required.

£.
(5) 764
6
45)84
20
16)80
12
9)60
4
2)40

£. s. d.
764 0 0
45 16 $9\frac{1}{2}$
809 16 $9\frac{1}{2}$
6
48)59 0 9
20
11)80
12
9)69
4
2)76

£. s. d.
809 16 $9\frac{1}{2}$
48 11 $9\frac{1}{2}$
858 8 7
6
51)50 11 6
20
10)11
12
1)38
4
1)52

£. s. d.
858 8 7
51 10 $1\frac{1}{4}$
909 18 $8\frac{1}{4}$
6
54)59 12 $1\frac{1}{2}$
20
11)92
12
11)05
4
-)22

£. s. d.
909 18 $8\frac{1}{4}$
54 11 11
964 10 $7\frac{1}{4}$
$4\frac{1}{2} = \frac{3}{4}$ of rate.
3858 2 5
482 5 $3\frac{1}{2}$
43)40 7 $8\frac{1}{2}$
20
8)07
12
0)92
4
3)70

£. s. d.
964 10 $7\frac{1}{4}$
43 8 $0\frac{3}{4}$ interest for nine months.
1007 18 8 =amount.
764 0 0 principal.
Ans. 243 18 8 the interest required.

		£.	s.	d.	
(6)	£5. is $\frac{1}{20}$)	57	10	6	first year's principal.
		2	17	$6\frac{1}{4}$	interest.
	$\frac{1}{20}$)	60	8	$0\frac{1}{4}$	second ditto.
		3	0	$4\frac{3}{4}$	interest.
	$\frac{1}{20}$)	63	8	5	third ditto.
		3	3	5	interest.
	$\frac{1}{20}$)	66	11	10	fourth ditto.
		3	6	7	interest.
	$\frac{1}{20}$)	69	18	5	fifth ditto.
		3	9	11	interest.
		73	8	4	
				$3\frac{1}{8}$	= rate for $7\frac{1}{2}$ months.
		220	5	0	
		9	3	$6\frac{1}{2}$	
	2)	29	8	$6\frac{1}{2}$	
		20			
	5)	88			
		12			
	10)	62			
		4			
	2)	50			

	£.	s.	d.	
	73	8	4	amount.
	2	5	$10\frac{1}{2}$	interest for $7\frac{1}{2}$ months.
	75	14	$2\frac{1}{2}$	whole amount.
	57	10	6	principal.
Ans.	18	3	$8\frac{1}{2}$	compound interest required

	£.	s.	d.
(7)	259	10	0
			4½
	1038	0	0
	129	15	0
11)	67	15	0
	20		
13)	55		
	12		
6)	60		
	4		
2)	40		

	£.	s.	d.	
	259	10	0	prin.
	11	13	6½	int.
	271	3	6½	prin.
			4½	
	1084	14	2	
	135	11	9¾	
12)	20	5	11¾	
	20			
4)	05			
	12			
0)	71			
	4			
2)	85			

	£.	s.	d.	
	271	3	6½	prin.
	12	4	0½	int.
	283	7	7	
			4½	
	1133	10	4	
	141	13	9½	
12)	75	4	1½	
	20			
15)	04			
	12			
0)	49			
	4			
1)	98			

	£.	s.	d.	
	283	7	7	
	12	15	0¼	
	296	2	7¼	
			3½	=rate for 9⅓ months.
	888	7	9¼	
	148	1	3½	
10)	36	9	1¼	
	20			
7)	29			
	12			
3)	49			

	£.	s.	d.	
	296	2	7¼	
	10	7	3¼	
	306	9	10½	amount.
	259	10	0	principal.
Ans.	46	19	10½	comp. int. required

REBATE OR DISCOUNT.

```
                                      £.
         (1) First, 6 months is ½) 6
                                    ---
                                      3
                               Add  100
                                    ---
Amount of £100. at given rate       103
                                    ---

          £.  £.    £.  s.
      As 103 : 3 :: 487 12
                         3
                  ---------
              103) 1462 16 (14l.
                   103
                   ---
                   432
                   412
                   ---
                    20
                    20
                   ---
                   416 (4s.
                   412
                   ---
                     4
                    12
                   ---
                    48 (0d.
                     4
                   ---
              103) 192 (¼
                   103
                   ---
                    89
                   ---

                          £.   s.   d.
As, From given sum       487  12   0
   Take the discount      14   4   0¼
                         ---  ---  ---
Present worth is         473   7  11¾ Ans.
```

	mo.	*£.*	*mo.*	*£.*	*s.*
(2)	As 12 :	5 ::	9 .	3	15
			Add	100	0
			Sum	103	15

£.	*s.*	*£.*	*£.*	*s.*
As 103	15 :	100 ::	357	10
20			20	
2075			7150	

Then $7150 \times 100 = 715000$.

And $715000 \div 2075 = \frac{715000}{83 \times 25} = \frac{28600}{83} = 344l.\ 11s.\ 6\frac{3}{4}d.$ 15 rem. present worth required.

	mo.	£.		mo.		£.		£.	s.	d.
(3) As	12	:	5	::	7	:	$2\frac{11}{12}$ =	2	18	4
							Add	100	0	0
							Sum	102	18	4

	£.	s.	d.		£.	s.	d.		£.	s.
As	102	18	4	:	2	18	4	::	275	10
		20				20				20
	2058				58				5510	
		12				12				12
	24700				700				66120	
									700	

247|00) 462840|00 ($\overset{12}{1873}$
247 ...
2158
1976
1824
1729
950
741
209
4
247) 836 ($\frac{3}{4}$
741
95

2,0) 15,6 1
7 16 $1\frac{3}{4}$ *Ans.*

(4) As 12*mo.* : £6. : : 9*mo.* : £4½, then £4. 10*s.*+ £100.=£104. 10*s.*=amount of 100 at 6 per cent.

	£.		£.		£.
As	104½	:	100	: :	109½
	2				2
	209				219

Then $\overline{219 \times 100} \div 209 = 21900 \div 209 = 104l.\ 15s.\ 8\frac{1}{4}d.$ present worth required, *Ans.*

(5) As 12*mo.* : £4¼ : : 7*mo.* : 2*l.* 9*s.* 7*d.* then 2*l.* 9*s.* 7*d.* +£100.=102*l.* 9*s.* 7*d.*=amount of £100.

	£.	s.	d.		£.		£.	s.	d.
As	102	9	7	:	100	: :	527	9	1
	20						20		
	2049						10549		
	12						12		
	24595						126589		

Then $\overline{126589 \times 100} \div 24595 = 2531780 \div 4914 =$ 514*l.* 13*s.* 10½*d.* 1386 rem.

(6) As 365 *days* : £5. : : 66 *days* : 18*s.* 0¾*d.* this added to £100.=100*l.* 18*s.* 0¾*d.*=amount.

As 100*l.* 18*s.* 0¾*d.* : 18*s.* 0¾*d.* : : 85*l.* 10*s* 0*d.* : 15*s.* 3½*d.* $\frac{62982}{96867}$. *Ans.*

	mo.		£.		*mo.*		£.	£.	s.	d.
(7) As	12	:	4½	: :	5	:	1⅞=	1	17	6
							Add	100	0	0
							As	101	17	6 : £100. : :

875*l.* 5*s.* 6*d.* : 859*l.* 3*s.* 3¼*d.* $\frac{3}{163}$=present worth, *Ans.*

	mo.	£.	*mo.*	£.	*s.*	*d.*
(8) As	12 :	5 : :	10 :	4	3	4
			Add	100	0	0
			As	104	3	4 : £100. : : £500. :

£480.=present worth, *Ans.*

	mo.	£.	*mo.*	£.	*s.*	*d.*
(9) As	12 :	5 : :	15 :	6	5	0
			Add	100	0	0
			As	106	5	0 : £100. : : £75. :

70*l.* 11*s.* 9*d.* present worth, *Ans.*

(10) As 12*mo.* : £5. : : 4*mo.* : 1*l.* 13*s.* 4*d.* this added to £100. gives 101*l.* 13*s.* 4*d.*=amount of £100. at the given rate per cent. for the time of the first payment.

By the rule, As 101*l.* 13*s.* 4*d.* : £100. : : £50. : 49*l.* 3*s.* 7$\frac{1}{4}$*d* present worth of the first payment.

Again for the second time of payment, (*viz.* 8 months.) As 12*mo.* : £5. : : 8*mo.* : 3*l.* 6*s.* 8*d.* this added to £100 gives 103*l.* 6*s.* 8*d.* then, as 103*l.* 6*s.* 8*d.* : £100 : : £50. : 48*l.* 7*s.* 8$\frac{3}{4}$*d.* present worth of second payment.

Again for the third time of payment, (*viz.* at 12 months.) As 12*mo.* : 5*mo.* : : 12*mo.* : £5 then £100+£5=£105

As £105. : £100. : : £50. : 47*l.* 12*s.* 4$\frac{1}{2}$*d.* Hence 49*l.* 3*s.* 7$\frac{1}{4}$*d.*+48*l.* 7*s.* 8$\frac{3}{4}$*d.*+47*l.* 12*s.* 4$\frac{1}{2}$*d.*=145*l.* 3*s.* 8$\frac{1}{2}$*d.* the present worth required, *Ans.*

(11) As 12*mo.* : £5. : : 3*mo.* : 1*l.* 5*s.* then £100.+1*l.* 5*s.*=101*l.* 5*s.*

As 101*l.* 5*s.* : 1*l.* 5*s.* : : 287*l.* 15*s.* (=half of 575*l.* 10*s.*) : 3*l.* 11*s.* 0$\frac{1}{2}$*d.* discount of the first payment. As 12*mo.* : £5. : : 6 : 2*l.* 10*s.* then £100+2*l.* 10*s.*=102*l.* 10*s.*

As 102*l.* 10*s.* : £100. : : 287*l.* 15*s.* : 7*l.* 0*s.* 4$\frac{1}{4}$*d.* discount of second payment.

Then 3*l.* 11*s.* 0$\frac{1}{2}$*d.*+7*l.* 0*s.* 4$\frac{1}{4}$*d.*=10*l.* 11*s.* 4$\frac{3}{4}$*d.*= required discount, *Ans.*

(12) First, As 12 : 4 : : 6 : 2 (mo. £. £.)

Add 100

As 102 : £100. : : £200. : £196. 1*s.* $6\frac{3}{4}$*d.* present worth of second payment.

£.
500
100
2)400
200

	£.		£.		£.	£.	s.	d.	
Again, As	104	:	100	: :	200 :	192	6	$1\frac{3}{4}$	present worth of
						196	1	$6\frac{3}{4}$	[third payment
					Add	100	0	0	sum paid down.
					Ans.	488	7	$8\frac{1}{2}$	=present worth.

EQUATION OF PAYMENTS.

(1) £.

$40 \times 3 = 120$

$60 \times 5 = 300$

$100 \times 10 = 1000$

2,00)14,20

Ans. $7\frac{1}{10}$ months.

(2) £.

$200 \times 3 = 600$

$100 \times 4 = 400$

$300 \times 5 = 1500$

$200 \times 6 = 1200$

8,00)37,00

$4\frac{5}{8}$ months.

Or 4 *mo.* 18 *days, Ans.*

(3)
$$\begin{array}{r} £. \\ 120\times2=240 \\ 200\times4=800 \\ 40\times5=200 \\ \hline 36{,}0 \quad)124{,}0 \\ \hline 3\tfrac{4}{9}\ \text{months.} \end{array}$$

Or 3*mo.* 13*days*, *Ans.*

(4)
$$\begin{array}{r} £. \\ 100\times\ 4=\ 400 \\ 150\times\ 6=\ 900 \\ 250\times12=3000 \\ \hline 5{,}00 \quad)43{,}00 \\ \hline 8\tfrac{3}{5}\ \text{months.} \end{array}$$

Or 8*mo.* 18*days*, *Ans.*

(5) Suppose the debt £24.

$$\begin{array}{r} £. \\ \text{then } 6\times2=12 \\ 3\times3=\ 9 \\ 3\times4=12 \\ 6\times5=30 \\ 3\times6=18 \\ 3\times7=21 \\ \hline 24 \quad)102 \end{array}$$

Ans. $4\frac{1}{4}$ months.

(6)
$$\begin{array}{r} £. \\ 60\times3=180 \\ 30\times6=180 \\ 30\times9=270 \\ \hline 12{,}0 \quad)63{,}0 \\ \hline 5\ 7 \end{array}$$

Ans. 5*mo.* 7*days.*

N.B. This method of finding the equated time is not strictly true, but is practised on account of its ease in calculation, for the error lies in making no difference between the interest and the discount, the discount being less than the interest.

BARTER.

(1) First
$$\begin{array}{r} cwt.\ \ lb. \\ 2=224 \\ 9 \\ \hline 2016 \end{array}$$
shillings value of the tea.

As 4*s.* : 1*lb.* : : 2016*s.* : 504*lb.* of chocolate, *Ans.*

(2) As $4d. : 5d. :: 32s. : 40s.$ what B ought to rate his hops at in barter.

As $40s. = 480d. : 1cwt. :: 11200d. : 20cwt. = 2240lbs.$ at $5d.$ is $11200d.$

Or as $3 : 1 :: 70 : 23\frac{1}{3}cwt. = 23cwt.\ 1qr.\ 9\frac{1}{3}lb.$ *Ans.*

(3) First, $4cwt.\ 2qrs. = 504lb.$ at $4s.$ *per* $lb.$ is $100l.\ 16s. = 2016s.$ As $9s. : 1lb. :: 2016s. : 224lb. = 2cwt.$ *Ans.*

	£.	s.	d.		£.	s.	
(4) First,	1	1	6	× 20(4 × 5)	=21	10	price of the cheese.
	3	14	0	× 8	=29	12	
				Ans.	8	2	the difference.

(5) First, $1s.\ 1\frac{1}{2}d. \times 3\frac{1}{2}lb. = 3s.\ 4\frac{1}{2}d. + 6\frac{3}{4}d. = 3s.\ 11\frac{1}{4}d.$ price of the pepper.

As $15\frac{1}{4}d. = 61 : 1lb. :: 3s.\ 11\frac{1}{4}d. = 47\frac{1}{4}d. = 189 : 3lb.\ 1oz.\ \frac{35}{61}$ of ginger, *Ans.*

		£.	s.	d
	(6) First, $2qrs.$ is $\frac{1}{2}$)	1	17	4
				3
	$16lb.$ is $\frac{1}{7}$)	5	12	0
$5s.\ 2d. = 62d.$		0	18	8
		0	5	4
	value of the tallow=	6	16	0=$1632d.$

As $62d. : 1doz. :: 1632d. : 26\frac{10}{31}doz. = 26doz.\ 3\frac{27}{31}lb.$ *Ans.*

	yds.	*s.*	*s.*	*£.*	*s.*	
(7) First,	608 ×	14 =	8512 =	425	12	value of the cloth.
				125	12	ready money.
				300	0	

As 85*cwt.* 2*qrs.* 24*lb.* Or = 9600*lb.* } : £300. : : 1*cwt.* = 112*lb.* $\frac{300 \times 112}{9600}$

$= \frac{336}{96} = \frac{28}{8} = 3l.$ 10*s.* = price of B 's bees-wax, *Ans.*

(8) First, 4*s.* 6*d.* × 320 = 1280 + 160 = 1440*s.* = £72. value of A 's candles. £72 — £30. = £42 Again, as 8*d.* : 1*lb.* : : £42 = 10080*d.* : 1260*lb.* = 45*qrs.* = 11*cwt.* 1*qr.* = quantity of cotton, *Ans.*

(9) First, 114*lb.* at 6*d.* *per lb.* is 684*d.* value of the tobacco. 1*s.* 2*d* = 14*d.*

As 14*d.* : 1*lb.* : : 684*d* : $48\frac{12}{14}$*lb* = $48\frac{6}{7}$*lb.* of cotton, *Ans.*

(10) First, As 7*s.* 6*d.* = 15 sixpences. 8*s.* = 16 sixpences.

As 15 : 9*d.* : : 16 : $9\frac{1}{2}$*d* $\frac{2}{5}$ rem. *per lb.* how D ought to rate his tobacco in barter, *Ans.*

PROFIT AND LOSS.

(1) As 11*s.* : £100. : : 12*s.* 6*d.* : $\frac{1250}{11}$ = £$113\frac{7}{11}$. = 113*l.* 12*s.* $8\frac{1}{2}$*d.* $\frac{10}{11}$ rem. from which deduct £100. the rem. is 13*l.* 12*s.* $8\frac{1}{2}$*d.* $\frac{10}{11}$ *Ans.*

(2) As £100 : £18 : : £108 : $\frac{1944}{100}$ = £19. $\frac{44}{100}$ = 19*l.* 8*s.* $9\frac{1}{2}$*d.* $\frac{2}{5}$ the advanced price of the Holland.

As 60 *ells* : 19*l.* 8*s.* $9\frac{1}{2}$*d.* $\frac{2}{5}$: : 1 *ell* : 6*s.* $5\frac{3}{4}$*d.* *Ans.*

(3) As 16*d.* : £100 : : 20*d.* : £125, then £125.— £100. = £25. per cent. *Ans.*

(4) As £112. : £560. : : £100. : £500. *Ans.* this is the fourth question.

(5) As 13*s*. 4*d*. : £100. : : 16*s*. : £120. then £120.—£100.=£20. per cent. *Ans*. this is the fifth question.

(6) As £100. : 27*s*. 6*d*. : : 115 : 27$\frac{1}{2}$*s*.×115÷100= 31*s*. $\frac{62\frac{1}{2}}{100}$=31*s*. 7$\frac{1}{2}$*d*.=1*l*. 11*s*. 7$\frac{1}{2}$*d*. *Ans*.

(7) As £120. : £490. : : 100 : 490×100÷120=$\frac{4900}{12}$ =£408$\frac{1}{3}$*s*.=408*l*. 6*s*. 8*d*.=prime cost of the cloth.

As 375 *yds*. : 408*l*. 6*s*. 8*d*. : : 1 *yd*. : 1*l*. 1*s*. 9$\frac{1}{4}$*d*. $\frac{1}{3}$ rem. *Ans*.

(8) As £6. 15*s*. : £125. : : £8. : £125×160*s*.÷135*s*. =20000÷135=148*l*. 2*s*. 11$\frac{1}{2}$*d*. from which take £100., the rem. is 48*l*. 2*s*. 11$\frac{1}{2}$*d*. *Ans*.

(9) First, 90 *ells*=450 *qrs*. As 450*qrs*. : £60. : : 4*qrs*. : 10*s*. 8*d*.=what one yard cost.

As £100 : 10*s*. 8*d*. : : £118 : 12*s*. 7*d*.—$\frac{4}{25}$ *Ans*.

(10) First, 19$\frac{1}{2}$ *cwt*.×10=195 *cwt*. 204*l*. 15*s*.÷195= 4095÷195=21*s*. what one *cwt*. was sold for. As 112*l*. 10*s*. : 21*s*. : : £100 : 42000÷2250=18*s*. 8*d*. *Ans*.

(11) First,

	yd. *s*. *d*.	*yds*.	£.	*s*.	*d*.	
As	1 : 10 4 : :	436 :	225	5	4	what the cloth was sold for.
As	1 : 8 6 : :	436 :	185	6	0	the cloth cost.
			39	19	4	gain, *Ans*.

(12) First, £69×14=£966, what the 14 tons of steel cost.

As 14*tons*×20=280*cwt*.=31360*lb*. at 6*d*. *per lb*. comes to £784, what the 14 tons of steel was sold for, then £966—£784=£182 loss, *Ans*.

(13) First, As £100 : £32 : : £115 : 36*l*. 16*s*. the advanced price of the linen.

As 124*yds*. : 36*l*. 16*s*. : : 1*yd*. : 5*s*. 11*d*. $\frac{28}{124}$=5*s*. 11*d*. $\frac{7}{31}$ *Ans*.

(14) First, 3*s*. 4*d*. is $\frac{1}{6}$) £. 249

	£.		
	41	10	0 prime cost.

	£.			
3*s*. 4*d*. is $\frac{1}{6}$)	249			
10*d*. is $\frac{1}{4}$)	41	10	0	
	10	7	6	
	51	17	6	retailing price.
	41	10	0	
	10	7	6	whole profit.

As 41*l*. 10*s*. : £100 :: 51*l*. 17*s*. 6*d*. : £125, then £125—£100=£25.

Ans. £25 *per cent*. profit, and 10*l*. 7*s*. 6*d*. whole profit.

SINGLE FELLOWSHIP.

(1) First, £20+£40=£60.

	£.		£.				£.	*s*.	*d*.
As	60	:	50	::	20	:	16	13	4
Or	6	:	5	::	40		33	6	8
						Proof	50	0	0

Ans. A's gain, 16*l*. 13*s*. 4*d*.; B's gain, 33*l*. 6*s*. 8*d*.

(2) First, £20+£30+£40=90.

		£.			£.
As	90 :	180	20	:	40=A's gain.
Or as	1 :	2 ::	30		60=B's gain.
			40		80=C's gain.
					180 proof.

(3) First, £364+£482+£500=1346.

£.	£.		£. s. d.		
As 1346 : 867 : :	364	:	234 9 $3\frac{1}{4}$	70=A's	gain, *Ans.*
	482		310 9 5	248=B's	
	500		322 1 $3\frac{1}{2}$	1028=C's	

(4) First, £227+£349+£115+£439=1130.

£.	£.		£.	s.	d.		
As 1130 : 428 : :	227	:	85	19	$6\frac{3}{4}$	690 B's	gain, *Ans.*
	349		132	3	9	120 C's	
	115		43	11	$1\frac{3}{4}$	250 D's	
	439		166	5	$6\frac{1}{4}$	70 E's	

(5) First, £750+£460+£500=1710.

£.	£.		£.	
As 1710 : 684 : :	750	:	300 D's	gain, *Ans.*
	460		184 E's	
	500		200 F's	

(6)

£. s. £. s.	£.	s.		£.	s.	d.	
As 836 7 : 675 15 : :	275	14	:	222	15	2	6584
	304	7		245	18	$1\frac{1}{2}$	15750
	152	0		122	16	$2\frac{3}{4}$	12227
	104	6		84	5	5	15620

gain, *Ans.*

(7) Suppose the stock £120, then $\frac{1}{3}$ is £40, $\frac{1}{4}$ is £30, $\frac{1}{5}$ is £24, and remainder 26.

			£.	s.	d.	
Then	120 : 100 : : 40 :		33	6	8	*Ans.*
	120 : 100 : : 30 :		25	0	0	
	120 : 100 : : 24 :		20	0	0	
	120 : 100 : : 26 :		21	13	4	
		Proof	100	0	0	

(8) First, £1700 × 24 = £40800, what the estate was sold for. Again,

$$\text{As } £27200 : £40800 :: \left\{\begin{array}{l} \overset{£.}{15000} : 22500 = \text{D's} \\ 12200 : 18300 = \text{E's} \end{array}\right\} \begin{array}{l}\text{share,} \\ \textit{Ans.}\end{array}$$

(9) First,

$$\begin{array}{l} \qquad\quad £. \\ 4+6+8=18 : 647 :: \end{array} \left\{\begin{array}{c} 4 \\ 6 \\ 8 \end{array}\right\} : \left\{\begin{array}{rrl} £. & s. & d. \\ 143 & 15 & 6\tfrac{2}{3} = \text{D's} \\ 215 & 13 & 4 = \text{E's} \\ 287 & 11 & 1\tfrac{1}{3} = \text{F's} \\ \hline 647 & 0 & 0 \text{ proof.} \end{array}\right\} \text{stock}$$

Again,

$$\begin{array}{l} \quad £. \quad £. \;\; s. \;\; d. \\ \text{As } 647 : 143\ 15\ 6\tfrac{2}{3} \end{array} \left\{\begin{array}{rrl} £. & s. & d. \\ 143 & 15 & 6\tfrac{2}{3} \\ 215 & 13 & 4 \\ 287 & 11 & 1\tfrac{1}{3} \end{array}\right\} : \left\{\begin{array}{rrl} £. & s. & d. \\ 31 & 19 & 0\ \tfrac{16}{27} = \text{D's} \\ 47 & 18 & 6\ \tfrac{24}{27} = \text{E's} \\ 63 & 18 & 0\tfrac{1}{4}\tfrac{5}{27} = \text{F's} \\ \hline 143 & 15 & 6\tfrac{2}{3} \text{ proof.} \end{array}\right\} \text{gain, } \textit{Ans.}$$

(10) £3 + £5 + £8 = £16.

$$\text{As } £16 : £100 :: \left\{\begin{array}{c} 3 \\ 5 \\ 8 \end{array}\right\} : \left\{\begin{array}{rrl} £. & s. & d. \\ 18 & 15 & 0 = \text{D's} \\ 31 & 5 & 0 = \text{E's} \\ 50 & 0 & 0 = \text{F's} \end{array}\right\} \text{stock, } \textit{Ans.}$$

DOUBLE FELLOWSHIP,

OR,

FELLOWSHIP WITH TIME.

(1) First, £. 40 × 3 = 120
75 × 4 = 300

Sum 420

As 420 : £70, { 120 / 300 } : { 20 = D's / 50 = E's } gain, *Ans.*
Or 6 : 1 : :

	£.	s.	d.	mo.	£.	s.	d.	d.
(2)	195	14	0 ×	3 =	587	2	0 =	140904
	169	18	3 ×	5 =	849	11	3 =	203895
	59	14	10 ×	11 =	657	3	2 =	157718
				Sum	2093	16	5 =	502517.

d. £. s.
As 502517 : 364 18 : :

	£.	s.	d.	rem.	
140904 :	102	6	4	3088 =	D's
203895 :	148	1	$1\frac{1}{2}$	=	E's
157718 :	114	10	$6\frac{1}{4}$	14707 =	F's

gain, *Ans.*

£.

(3) 500 × 5 = 2500
Subtract 200

300 × 5 = 1500
Add 300

600 × 4 = 2400
Subtract 130

470 × 4 = 1880

8280 for D.

£.

400 × 3 = 1200
Add 270

670 × 6 = 4020
Subtract 140

530 × 3 = 1590
Add 100

630 × 3 = 1890
Subtract 99

531 × 3 = 1593

10293 for E.

8280 for D.
10293 for E.
14300 for F.

Sum 32873 = sum of the products.

£.

900 × 6 = 5400
Subtract 200

700 × 5 = 3500
Add 500

1200 × 2 = 2400
Subtract 600

600 × 5 = 3000

14300 for F.

Then, £.
As 32873 : 200 : :

	£.	s.	d.	
8280 :	50	7	6	21720 = D's
10293 :	62	12	$5\frac{1}{2}$	29859 = E's
14300 :	87	0	$0\frac{1}{2}$	14167 = F's
	200	0	0 proof.	

gain, *Ans.*

	oxen		days	
(4)	23	×	27	=621
	21	×	35	=735
	16	×	23	=368
			Sum	1724

		£.	s.	d.	rem.
As 1724 : 36*l.* 10*s.* 6*d.* : :	621 :	13	3	$1\frac{1}{2}$	624
	735 :	15	11	5	1688
	368 :	7	15	11	1136
		36	10	6	proof.

	£.	s.	d.			
Ans.	13	3	$1\frac{1}{2}$	624	D's	share of the rent.
	15	11	5	1688	E's	
	7	15	11	1136	F's	

ALLIGATION.

ALLIGATION MEDIAL.

	bush.		s.	
(1)	20	×	5	=100
	36	×	3	=108
	40	×	2	= 80
	96		Sum	288

As 96 : 288*s.* : : 1 : 3*s.* per bushel, *Ans.*

	gal.		s.	d.		s.	d.
(2)	15	×	8	0	=	120	0
	20	×	7	4	=	146	8
	10	×	6	8	=	66	8
	24	×	4	0	=	96	0
	69					429	4

As 69 : 429*s.* 4*d.* : : 6*s.* $2\frac{1}{2}$*d.* $\frac{46}{69}$, *Ans.*

	£.	s.	cwt.	£.	s.
(3)	2	16	×4=	11	4
	2	3	×7=	15	1
	1	17	×5=	9	5
			16	35	10

	cwt.	*£.*	*s.*		*cwt.*	
As	16 :	35	10	: :	2 :	
Or as	8 :				1 :	4*l.* 8*s.* 9*d.* *Ans.*

	£.	s.	qrs.	£.
(4)	1	8	×30=	42
	1	10	×46=	69
	1	5	×24=	30
			100	141

As 100 *qrs.* : £141 : : 1=8 *bushels* : 1*l.* 8*s.* $2\frac{1}{4}$*d.* $\frac{6}{10}$, *Ans.*

	s.	d.	bush.	s.	d.
(5)	5	6	×27=	148	6
	4	0	×27=	108	0
	2	8	×14=	37	4
			68	293	10

As 68 *bush.* : 293*s.* 10*d.* : . 4*s.* $3\frac{3}{4}$*d.* $\frac{28}{68}$, *Ans.*

	gal.	s.	d.	s.	d.
(6)	20×	5	4=	106	8
	12×	5	0=	60	0
	30×	6	0=	180	0
	20×	4	6=	90	0
	82			436	8

As 82 *gal.* : 436*s.* 8*d.* : : 5*s.* $3\frac{3}{4}$*d.* $\frac{50}{82}$, *Ans.*

	lb.	*oz.*	*oz.*
(7)	12	× 6 =	72
	8	× 7 =	56
	10	× 8 =	80
	30		208

As 30 *lb.* : 208 *oz.* :: 1 *lb.* : 6 *oz.* 18 *dwts.* 16 *grs.* *Ans.*

	lbs.	*d.*	*d.*
(8)	50	× 11 =	550
	30	× 14 =	420
	25	× 22 =	550
	37	× 24 =	888
	142		2408

As 142*lb.* : 2408*d.* : 1*lb.* : 16$\frac{3}{4}$*d.* $\frac{118}{142}$, *Ans.*

ALLIGATION ALTERNATE.

		d.		*d.*	*d.*
(1)	22*d.*	18	6 at	18 is	108
		20	2 at	20 is	40
		24	2 at	24 is	48
		28	4 at	28 =	112
			14		14) 308
					proof 22 pence.

Ans. 6 at 18*d.*, 2 at 20*d.*, 2 at 24*d.*, and 4 at 28*d.* each.

(2)	8*d.*	4	2
		6	2
		10	4 × 2 = 6

Ans. 2*lb.* at 4*d.*, 2*lb.* at 6*d.*, 6*lb.* at 10*d.* *per lb.*

(3)

s.		
10*s*.	16	2
	14	1
	9	4
	8	6

Ans. 2*lb.* of tea at 16*s.*, 1*lb.* ditto at 14*s.*, 4*lb.* of ditto at 9*s.*, 6*lb* ditto at 8*s. per lb.*

(4)

£.		
30*d*.	42	6
	48	6
	24	12+18=30

Ans. 6 *bushels* of barley, 6 of rye, and 30 of oats.

(5)

d.		
5*d*.	7	1
	6	1
	4	2×1= 3

Ans. 1*lb.* of sun raisins, 1*lb.* of Malagas, and 3*lb.* of Smyrnas.

(6)

d.		
20*d*.	24	2+5=7
	18	4
	15	4

Ans. 7*lb.* of tobacco at 2*s.*, 4*lb.* at 1*s.* 6*d.*, and 4*lb.* at 1*s.* 3*d. per lb.*

ALLIGATION PARTIAL.

(1)

17*d*.	15	5	the difference found by Alligation Alternate.
	16	1	
	18	1	
	22	2	

$$\text{As } 5 : \left\{\begin{matrix}1\\1\\2\end{matrix}\right\} :: 20 : \left\{\begin{matrix}4\\4\\8\end{matrix}\right.$$

Ans. 4*lb.* at 16*d.* and 18*d.* and 8*lb.* at 22*d.* to mix with the 20*lb.* of tobacco at 15*d.*

(2)

	d.				*d.*	
32*d.*	60	14	or thus, 32*d.*		60	8
	36	8			36	14
	24	4			24	28
	18	28			18	4

As 8 : 20 :: { 14 : 35
Or as 2 : 5 { 28 : 70
{ 4 : 10

Ans. 35 bushels of rye, 70 of barley, 10 of oats, to be mixed with 20 bushels of wheat.

(3)

8*s.*	12	1+4 = 5
	7	4
	4	4

As 5*s*. . 4 : : 40 : 32. As 5 : 4 : : 40 : 32.

Ans. 32 gallons of English, 32 gallons of spirits to mix with 40 gallons of French brandy.

(4)

	s.	
8*s.*	12	4
	10	2
	6	2
	4	4

As 4 : { 2 : : 20 : 10
{ 2 : : 20 : 10
{ 4 : : 20 : 20

Ans. 10*lb.* at 6*s.*, 10*lb.* at 10*s.*, and 20*lb.* at 12*s. per lb.* to mix with 20*lb.* of tea at 4*s. per lb.*

(5)

	d.	
72*d.*	81	12
	90	21
	60	9
	51	18

As 12 : { 21 : : / 9 : : / 18 : : } 18 : { $31\frac{1}{2}$ / $13\frac{1}{2}$ / 27

Ans. $31\frac{1}{2}$ gallons of Malaga, $13\frac{1}{4}$ gallons of Sherry, 27 gallons of white wine, to mix with 18 gallons of Canary, at 6*s.* 9*d. per* gallon.

ALLIGATION TOTAL.

(1)

$$8d.\left\{\begin{array}{l}d.\\12\\10\\6\\4\end{array}\right. \left.\begin{array}{r}\\4\\2\\2\\4\end{array}\right\}$$ the differences found by Alligation Alternate.

Sum 12

$$\text{As } 12 : \left\{\begin{array}{c}4\\2\\2\\4\end{array}\right\} :: 144lb. : \left\{\begin{array}{c}48\\24\\24\\48\end{array}\right\}$$ equal the number of pounds of each sort, as required.

(2)

$$7s.\left\{\begin{array}{l}s.\\5\\6\\8\\9\end{array}\right. \begin{array}{r}\\2\\1\\1\\2\end{array}$$

Sum 6

$$\text{As } 6 : \left\{\begin{array}{c}2\\1\\1\\2\end{array}\right\} :: 87lb. : \left\{\begin{array}{c}lbs.\\29\\14\frac{1}{2}\\14\frac{1}{2}\\29\end{array}\right\}$$ equal the number of pounds of each sort, as required.

$$\text{Or thus, } 7s.\left\{\begin{array}{l}s.\\5\\6\\8\\9\end{array}\right. \begin{array}{r}\\1\\2\\2\\1\end{array} \quad \text{As } 6 : \left\{\begin{array}{c}1\\2\\2\\1\end{array}\right\} :: 87lbs. : \left\{\begin{array}{c}lbs.\\14\frac{1}{2}\\29\\29\\14\frac{1}{2}\end{array}\right\}$$

Sum 6

equal the number of pounds of each sort, as required.

(3)

		s.
5s.	4	5+3+1=9
	6	1
	8	1
	10	1
	Sum	12

As 12 : $\left\{\begin{matrix}9\\1\\1\\1\end{matrix}\right\}$: : 60 gal. : $\left\{\begin{matrix}45\\5\\5\\5\end{matrix}\right\}$ equal the number of gallons of each sort, as required.

(4)

17 *carats*	24	2
	22	2
	20	2
	15	7+5+3=15
	Sum	21

As 21 : $\left\{\begin{matrix}2\\2\\2\\15\end{matrix}\right\}$: : 42 oz. : $\left\{\begin{matrix}4\\4\\4\\30\end{matrix}\right\}$ that is, 4 of 24, 4 of 22, 4 of 20, and 30 of 15 carats fine, *Ans.*

(5)

	s.	
6s.	8	2+1=3
	5	2
	4	2
	Sum	7

As 7 : $\left\{\begin{matrix}3\\2\\2\end{matrix}\right\}$: : 28*lb.* : $\left\{\begin{matrix}12\\8\\8\end{matrix}\right\}$ equal the pounds of each, answering to 28*lb.* at 6*s.* *per lb.* as required.

$$\text{Again, } 7s. \begin{cases} 8 \\ 5 \\ 4 \end{cases} \quad \begin{array}{r} 2+3=5 \\ 1 \\ 1 \\ \hline \text{Sum } 7 \end{array}$$

$$\text{As } 7 : \begin{Bmatrix} 5 \\ 1 \\ 1 \end{Bmatrix} :: 42lb. : \begin{Bmatrix} 30 \\ 6 \\ 6 \end{Bmatrix}$$ equal the pounds of each, answering to 42*lb.* at 7*s. per lb.* as required.

SINGLE POSITION,

OR,

THE RULE OF FALSE.

(1) Suppose he had 36 scholars, then as many, half as many, and one quarter as many more will be $=36+36+18+9=99$ total.

As 99 : 88 : : 36 : 32=number of scholars, *Ans.*

(2) Suppose the person had 24 pieces.

One third is $=8$
One fourth $=6$
One sixth $=4$
18 total.

As 18 : 54 : : 24
Or as 1 : 3 : : 24 : 72=number of Portugal pieces required, *Ans.*

(3) Suppose the harness to be £4, the horse=£8, the chaise $=\overline{8+4}\times 2=12\times 2=24$, then $4+8+24=36=$total.

£.
As 36 : 60 : : 4
Or as 9 : 60 : : 1 : £$6\frac{2}{3}$ = 6*l.* 13*s.* 4*d.* = price of the harness.

6*l.* 13*s.* 4*d.* × 2 = 13*l.* 6*s.* 8*d.* = price of the horse
then $\overline{6l.\ 13s.\ 4d.+13l.\ 6s.\ 8d.}\times 2=20\times 2=$ £40.
= price of the chaise, *Ans.*

(4) Suppose A's part to be £24, then B's part=£24+8=£32, and C's part=£32+£8=£40, now £24+£32+£40=£96 the total.

	£.		£.		£.	
As	96	:	120	::	24	
Or as	4	:	120	::	1	: £30=A's part, then £30+£10=£40=B's part, and £40+£10=£50=C's part, *Ans.*

	£.
(5) Suppose the sum lent to have been........	100
Then the interest of £100 for 10 years is..	60
Total	160

	£.		£.		£.	
As	160	:	300	::	100	
Or as	8	:	300	::	5	: 187*l.* 10*s.* sum lent, *Ans.*

DOUBLE POSITION.

(1) Suppose A had £30, then 30+36+44=110 the result, but it should have been £200; the difference or error is £90 too little.

Again, suppose A had £36, then 36+42+50=£128, but should have been £200; the error is £72 too little. By the rule then £90−£78=£18 the divisor; and

$$\frac{\overline{36\times 90}-\overline{30\times 72}}{18}=\frac{1080}{18}=\frac{120}{2}=$$ £60 = A's share, and £66=B's, and £74=C's share, *Ans.*

(2) Suppose the weight of the lesser cup=1*oz.* then 1+5 = 6*oz.*=double of the greater; and $\frac{6}{2}$+5 = 8*oz.* which should have been 3*oz.*; 8*oz.*−3*oz.*=5*oz.*=first error. Again, suppose the weight of the lesser cup=2*oz.* then 2+5=7=double the greater; and $3\frac{1}{2}$+5=$8\frac{1}{2}$ *oz.*

which should have been 6 *oz.* then the second error is $2\frac{1}{2}$; here the errors are alike, whence by the rule $\frac{5\times2-1\times2\frac{1}{2}}{2\frac{1}{2}}$ $=\frac{20-5}{5}=\frac{15}{5}=3$ *oz.*=weight of the lesser cup, and $\frac{3+5}{2}$ $=4$ *oz.*=weight of the greater cup, *Ans.*

(8) Suppose the horse cost *£1, then £4=price of the garden, and $4\times5=$ £20 that of the house, then $1+4+20=$ £25, but should be £500; the difference is £475, first error. Again, suppose the horse $=0$, then the garden and house are each $=0$, and the second error=£500; here the errors are alike, whence by the rule $\frac{500\times1-475\times0}{500-475}$ $=\frac{500}{25}=$ £20 the value of the horse, then £$20\times4=$ £80 =value of the garden, and £$80\times5=$ £400, value of the house, *Ans.*

N.B. For the supposed numbers *1 and 0 will be found to have the preference in the solution of a number of questions.

(4) Suppose L=1, then $K=30\frac{1}{4}$, but by the question L should $30+30\frac{1}{4}=60\frac{1}{4}$, then $60\frac{1}{4}-1=59\frac{1}{4}$, first error. Again, suppose L=0 then K=30, but by the question L should be $30+30=60$, then $60-0=60$, second error; here the errors are alike; whence by the rule $\frac{60\times1+59\frac{1}{4}\times0}{\frac{3}{4}}$ $=\frac{60}{\frac{3}{4}}=\frac{60\times4}{3}=\frac{240}{3}=80$ years = L's age, and $80-30=$ 50 years=K's age, *Ans.*

(5) Suppose D took 1 crown, then E took $1+15=16$ crowns, and F took $\frac{1+16}{5}=\frac{17}{5}=3\frac{2}{5}$ crowns, then $1+16+3\frac{2}{5}=20\frac{2}{5}$, but should be 324; $324-20\frac{2}{5}=303\frac{3}{5}$, first error. Again, suppose D got 0, then E got 15 crowns,

and $F\frac{15}{5}=3$ crowns, and $0+15+3=18$, but should be 324, the difference is $306=$second error, and both errors are alike; by the rule $\frac{\overline{306\times1}-\overline{303\frac{3}{5}\times0}}{306-303\frac{3}{5}}=\frac{306}{2\frac{2}{5}}=\frac{1530}{12}=$ $127\frac{1}{2}$ crowns$=$D's share, $127\frac{1}{2}+15=142\frac{1}{2}$ crowns$=$E's share, and $\frac{127\frac{1}{2}+142\frac{1}{2}}{5}=270\div5=54$ crowns, F's share, *Ans.*

(6) Suppose there were 4 maids.
Twice as many 8

—

12, that is 2 above 10, but should
— have been 6, then $6-2=4$,
too few.

Again, suppose 6, twice as many 12; $6+12=18$, which is 8 above 10, but should have been 4, then $8-4=4$ too many, and both errors are unlike; by the rule $\frac{6\times4+\overline{4\times4}}{4\div4}$ $=\frac{40}{8}=5$ maids, *Ans.*

Or thus, suppose there were only 1, twice as many$=2$, then $2+1=3$; as there wants 9, (that is $10-1$) but should be $10+9=19$, then $19-3=16=$first error. Again, suppose there were 0, then 10 under and 10 above 10 gives $20=$second error, and being both alike, we have by the rule $\frac{20\times1+16\times0}{20-16}=\frac{20}{4}=5$ maids, *Ans.* as before.

EXCHANGE.

1. WITH FRANCE.

(1) First, as 54*d.* : 1*cr.* : : £180 × 240*d.* : $£\frac{180 \times 240}{54} = \frac{4800}{6} = 800$ crowns, *Ans.*

(2) First, as 1*cr.* : 56*d.* : : 758*cr.* : 42448*d.* = 3537*s.* 4*d.* = 176*l.* 17*s.* 4*d.* *Ans.*

(3) First, as 56*d.* : 1*cr.* : : 176*l.* 17*s.* 4*d.* = 42448*d.* $\frac{42448}{56} = \frac{5306}{7} = 758$ crowns, *Ans.*

(4) First, as 1 *cr.* : $54\frac{1}{2}$*d.* : : 725 *cr.* 17 *sols.* 7 *den.* = 522211 *den.* : $\frac{522211 \times 54\frac{1}{2}d.}{1 \times 3 \times 20 \times 12} = 39528\frac{679}{1440}d.$ = 164*l.* 14*s.* $0\frac{1}{4}d.\frac{210}{360}$, or 164*l.* 14*s.* $0\frac{1}{2}$*d.* nearly, *Ans.*

(5) First, as $54\frac{1}{2}$*d.* : 1*cr.* : : 164*l.* 14*s.* $0\frac{1}{2}$*d.* = $39528\frac{1}{2}$*d.* : $\frac{39528\frac{1}{2}}{54\frac{1}{2}} = \frac{79057}{109} = 725$*cr.* 17 *sols.* $7\frac{41}{109}$*den.* *Ans.*

2. WITH SPAIN.

(6) First, as 1 *piece* : 56*d.* : : 2547 *pieces* : 2547 × 56 = 142632*d.* = 594*l.* 6*s.* 0*d.* *Ans.*

(7) First, as 56*d.* : 1 *piece* : : 594*l.* 6*s.* 0*d.* = 142632*d.* : $\frac{142632}{56} = \frac{17829}{7} = 2547$ pieces of eight, *Ans.*

(8) First, as $57\frac{1}{2}$*d.* : 1 *piece of eight* : : £2500 = 600000*d.* : $\frac{600000}{57\frac{1}{2}} = \frac{2400000}{230} = 10434$ *pieces of eight.* 6 *rials.* $8\frac{20}{23}$*marv.* *Ans.*

3. WITH ITALY.

(9) First, as 1 *dol.* : 53*d.* : : 976 *dol.* : 976 × 53 = 51728*d.* = 4310*s.* 8*d.* = 215*l.* 10*s.* 8*d.* *Ans.*

(10) First, as 1 *duc.* : 54*d.* : : 250 *duc.* : 13500*d.* = 1125*s.* = 56*l.* 5*s.* 0*d.* *Ans.*

(11) First, as 1 *duc.* : 4*s.* 5*d.* : : 275 *duc.* : 275 × 53 = 14575*d.* = 1214*s.* 7*d.* = 60*l.* 14*s.* 7*d.* *Ans.*

(12) First, as 4*s.* 5*d.* : 1 *duc.* : : 60*l.* 14*s.* 7*d.* : $\frac{60l. 14s. 7d.}{4s. 5d.}$ $= \frac{14575}{53} =$ 275 Venice ducats, *Ans.*

4. WITH PORTUGAL.

(13) First, as 1 *milrea* : 6*s.* 5*d.* : : 2750 *milreas*: 2750 × 77*d.* = 211750*d.* = 17645*s.* 10*d.* = 882*l.* 5*s.* 10*d.* *Ans.*

(14) First, as 1 *milrea* : 5*s.* $5\frac{5}{8}d.$: : 4366 *milr.* 183 *reas*: $\frac{4366183 \times 525}{1 \times 1000} = 2292246\frac{75}{1000} = \frac{2292246\frac{75}{1000}}{8 \times 12 \times 20} =$ 23877*s.* $6\frac{3}{4}d.$,0375 = 1193*l.* 17*s.* $6\frac{3}{4}d.$,0375. *Ans.*

(15) First, as 5*s.* $5\frac{5}{8}d. = 65\frac{5}{8}d. = 525$: 1 *milrea* : : 1193*l.* 17*s.* $6\frac{3}{4}d.$,0375 : $\frac{2292246,075}{525} =$ 4366 *milr.* 183*reas*, *Ans.*

5. WITH HOLLAND, FLANDERS, AND GERMANY.

(16) First, as £1 : 33*s.* 6*d.* : : 754*l.* 10*s.* : £$754\frac{1}{2}$ × $33\frac{1}{2}s. \div 20 = \frac{25275\frac{1}{4}}{20} =$ 1263*l.* 15*s.* 9*d.* *Ans.*

(17) First, as $33\frac{1}{2}s.$: £1 : : 1263*l.* 15*s.* 9*d.* : $\frac{1263l. 15s. 9d.}{33\frac{1}{2}}$ $= \frac{303309}{402} =$ 754*l.* 10*s.* *Ans.*

(18) First, as £1 : 34 *schel.* $4\frac{1}{2}$ *gr.* : : 852*l.* 12*s.* 6*d.*: 852*l.* 12*s.* 6*d.* × 34 *schel.* $4\frac{1}{2}$*gr.* = $\frac{204630d. \times 412\frac{1}{2}\ groats}{240}$ = 351707 *groats* $6\frac{1}{2}$ *pen.* = 175853 *stivers* $14\frac{1}{2}$ *pen.* = 8792 *guilders* 13 *stiv.* $14\frac{1}{2}$ *pen.* *Ans.*

(19) First, as 34 *sch.* $4\frac{1}{2}$ *groats* : £1 : : 8792 *guil.* 13*st.* $14\frac{1}{2}$ *pen.* : 852*l.* 12*s.* 6*d.* *Ans.*

Note, This answer being the reverse of the last, it is not necessary to put down the work at length; the same may be observed in other examples.

How to convert Bank Money into Current, and Current into Bank, and the contrary.

$$\begin{array}{lrcrl} & \pounds. & & \pounds. & \textit{guil. stiv.} \\ \text{(20) As} & 104\frac{3}{8} & : & 100 :: & 794 \quad 15 \\ & 20 & & & 20 \\ \hline & 2087\frac{1}{2} & & & 15895 \\ & 16 & & & 16 \\ \hline & 33400 & & & 254320 \\ & & & & 100 \\ \hline & & & 33400) & 25432000 \end{array}$$

761 *guil.* 8 *stiv.* $11\frac{147}{167}$ *pen. Ans.*

(21) First, as 100 : $104\frac{3}{8}$: : 761 *guil.* 9 *stiv.* : 794 *guil.* 15 *stiv.* $4\frac{3}{10}$ *pen. Ans.*

6. WITH IRELAND.

(22) As £100 : £110 : : 575*l.* 15*s.* : $\frac{575l.\ 15s. \times 11}{10}$
Or as 10 : 11
$=$633*l.* 6*s.* 6*d.* *Ans.*

(23) As £110 : £100 : : 633*l.* 6*s.* 6*d.* : $\frac{633l.\ 6s.\ 6d. \times 10}{11}$
Or as 11 : 10
$= \frac{6333l.\ 5s.\ 0d.}{11} =$ 575*l.* 15*s.* 0*d.* *Ans.*

COMPARISON OF WEIGHTS AND MEASURES.

(1) First, as 65 *fr. d.* : 50 *du.* : : 350 *fr.* : $\frac{350 \times 50}{65} = \frac{70 \times 50}{13} = \frac{3500}{13} = 269\frac{3}{13}$. *Ans.* $269\frac{3}{13}$ Dutch pence.

(2) First, as 12 *yds.* : 8 *ells* : : 64 *yds.* : $\frac{64\times8}{12}=\frac{512}{12}=42\frac{2}{3}$ *ells* at Paris, *Ans.*

(3) First, as 28*lb.* : 30*lb.* : : 350*lb.* : $\frac{350\times30}{28}=\frac{10500}{28}=\frac{2625}{7}=375$*lb. Ans.*

(4) First, as 95*Fl.lb.* : 100*En.lb.* : : 275*Fl.lb.* : $\frac{275\times100}{95}=\frac{27500}{95}=\frac{5500}{19}=289\frac{9}{19}$ *En. lbs. Ans.*

CONJOINED PROPORTION.

	lb.		*lb.*
(1)	20 at London	=	23 at Antwerp.
	155 at Antwerp	=	180 at Leghorn.
	72 at Leghorn	=	

Then by the rule $\frac{20\times155\times72}{23\times180}=\frac{223200}{4140}=53\frac{378}{414}$ *lb. Ans.*

	lb.		*lb.*
(2)	12	=	10
	100	=	120
	40	=	

By the rule $\frac{12\times100\times40}{10\times120}=\frac{48000}{1200}=40$*lb. Ans.*

	braces		*braces*
(3)	140	=	156 at Leghorn.
	7	=	4 *ells* English.
	16	=	

By the rule $\frac{140\times7\times16}{156\times4}=\frac{15680}{624}=25\frac{80}{624}$ *braces,* at Venice, *Ans.*

	lb.		*lb.*
(4)	40 at London	=	36 at Amsterdam.
	90 at Amsterdam	=	116 at Dantzick.
	130 at Dantzick	=	

By the rule $\frac{468000}{4176}=\frac{40\times 90\times 130}{36\times 116}=112\frac{288}{4176}$ *lb.* at London, *Ans.*

	lb.		*lb.*
(5)	120 at Thoulouse	=	100 at Amsterdam.
	10 at Amsterdam	=	12 at London.
	40 at London	=	

By the rule $\frac{120\times 10\times 40}{12\times 100}=\frac{48000}{1200}=40$*lb.* at Thoul. *Ans.*

	lb.		*lb.*
(6)	116 at Dantzick	=	90 at Amsterdam.
	36 at Amsterdam	=	40 at London.
	122 at London	=	

By the rule $\frac{116\times 36\times 122}{90\times 40}=\frac{500472}{3600}=141\frac{1872}{3600}$ *lbs.* at Dantzick, *Ans.*

ARITHMETICAL PROGRESSION.

RULE I.

(1) Here, $1+12=13$ the sum of the two extremes.
$12=$ to the number of terms.

2) 156

$78=$number of strokes, *Ans.*

This question (or any other) may be solved in the following manner, by adding the same series to itself, with the terms in an inverted order, thus :

The given series.

$1+2+3+4+5+6+7+8+9+10+11+12$

The same series inverted.

$12+11+10+9+8+7+6+5+4+3+2+1$

$13+13+13+13+13+13+13+13+13+13+13+13$
$=156$ sum, half of which is $78=$ sum of the series the same as before. This curious property of numbers is of a considerable use in many parts of mathematical and philosophical science.

(2) $2s.+10s.=\overline{12\times17}\div2=102s.=5l.\ 2s.$ amount required, *Ans.*

(13) In this question $2+200=202$ sum of the two extremes
$50=$ half the number of terms.

10100 yards, which, divided by 1760, gives 5 *miles* 1300*yds.* distance the man ran to take up the eggs, *Ans.*

RULE II.

(4) Here by the rule $\frac{32-4}{8-1}=\frac{28}{7}=4$ common difference, *Ans.*

(5) Here $\frac{58-3}{12-1}=\frac{55}{11}=5$ miles the daily increase; then $\overline{58+3}\times12\div2=61\times6=366$ miles the distance of the place from London, *Ans.*

RULE III.

(6) Here by the rule $\frac{58-3}{5}+1=\frac{55}{5}+1=11+1=12$ the number of days, *Ans.*

(7) $\frac{32-4}{4}+1=\frac{28}{4}+1=7+1=8$ the number of sons, *Ans.*

RULE IV.

(8) By the rule $46-\overline{10-1}\times 4=46-\overline{9\times 4}=46-36=$ 10 miles the first day's journey, *Ans.*

(9) $46-\overline{8-1}\times 6=46-\overline{7\times 6}=46-42=4s.$ *Ans.*

RULE V.

(10) By the rule $\frac{360}{12}=30$, then $30-\frac{\overline{12-1}\times 4}{2}=30-\frac{\overline{11\times 4}}{2}=30-22=£8.$ first payment, *Ans.*

RULE VI.

(11) By the rule, $\overline{20\times 8}-8=160-8=152$, then $152+2=158$ last number, *Ans.*

N.B. It is to be observed, that in a series of odd numbers, (beginning with unity) as 1, 3, 5, 7, 9, 11, 13, 15, 17, &c. the sum of any number of terms will be equal to the square of the number of terms given.

EXAMPLES.

1. Ex. Required the sum of eight terms, to wit, 1, 3, 5, 7, 9, 11, 13, 15=64=8×8=64, *Ans.*

2. Ex. Required the sum of 11 terms, to wit, 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21=121=11×11=121, *Ans.*

GEOMETRICAL PROGRESSION.

RULE I.

(1) First, $\begin{cases} 0. & 1. & 2. & 3. & 4 \text{ exponents or indices.} \\ 1. & 2. & 4. & 8. & 16 \text{ terms in Geom. Prog.} \end{cases}$

Then by the rule $\begin{cases} 4+4=8.\ 8+3=11. \\ 16\times 16=256\times 8=2048 \text{ farth.}=11t \end{cases}$

which is accounted the 12th term, or last, then $\frac{2048}{4\times 12\times 2}$

$=\frac{2048}{960}=\frac{256}{120}=2l.\ 2s.\ 8d.$ *Ans.*

(2) First $\begin{cases} 0. & 1. & 2. & 3. & 4. & 5. & 6 \text{ exponents or indices.} \\ 1. & 2. & 4. & 8. & 16. & 32. & 64 \text{ farthings, or terms,} \end{cases}$ Geom. Prog. then $5+5+6+6=22$, or to be accounted the 23d term.

And $32\times32\times64\times64=1024\times4096=4194304$ farthings $=4194304\div4\times12\times20=1048576d.\div12\times20=87381s.$ $4d.=4369l.\ 1s.\ 4d.$ *Ans.*

RULE II.

(3) First $\begin{cases} 0. & 1. & 2. & 3. & 4 \text{ exponents or indices.} \\ 20. & 60. & 180. & 540. & 1620 \text{ pounds in Geo. Pro.} \end{cases}$ then $3+4=7$, which is to be accounted the 8th or last term.

And $\overline{540\times1620}\div20=874800\div20=£43740$, *Ans.*

(4) First $\begin{cases} 0. & 1. & 2. & 3. & 4. & 5 \text{ exponents or indices,} \\ 50. & 100. & 200. & 400. & 800. & 1600 \text{ pounds in} \end{cases}$ Geom. Prog. then $4+5=9$ or 10th term, that is for the 9 sons and executors $=10$.

And $\overline{800\times1600}\div50=£25600$. *Ans.*

RULE III.

(5) First $\begin{cases} 0. & 1. & 2. & 3. & 4. & 5 \text{ exponents.} \\ 1. & 4. & 16. & 64. & 256. & 1024 \text{ farthings in Geom.} \end{cases}$ Prog. then $5+5+1=11$ or 12th, or last term.

And $1024\times1024\times4=4194304$ farthings in the last term.

By the rule $\dfrac{4194304-1}{\text{ratio } 4-1}=\dfrac{4194303}{3}=1398101$, then $1398101+4194304=5592405$ farthings $=5825l.\ 8s.\ 5\frac{1}{4}d.$ amount of his wages, *Ans.*

(6) First $\begin{cases} 0. & 1. & 2. & 3. & 4. & 5. & 6. & 7. & 8 \text{ exp.} \\ 1. & 3. & 9. & 27. & 81. & 243. & 729. & 2187. & 6561 \text{ terms} \end{cases}$ in Geom. Progres. then $8+8+8+7=31$ or 32d, or last term.

And $6561\times6561\times6561\times2187=282429536481\times2187$ $=617673396283947$=last or 32d term in far. by the rule

sub. 1=first term.

617673396283946 this divided by $3-1=2$

gives 308836698141973 to

this add the last term = 617673396283947

whole sum 926510094425920 farth.

=231627523606480*d.*=965114681693*l.* 13*s.* 4*d.* *Ans.*

(7) First $\begin{cases} 0. & 1. & 2. & 3. & 4. & 5. & 6 \text{ exponents.} \\ 1. & 2. & 4. & 8. & 16. & 32. & 64 \text{ terms in Geom. Prog.} \end{cases}$

$5+6=11$th or 12th, or last term.

$64\times32=$ 2048=last term.

sub. 1=first term.

2047

last term=2048 add.

4095 shillings=204*l.* 15*s.* 0*d.* *Ans.*

(8) First $\begin{cases} 0. & 1. & 2. & 3. & 4. & 5. & 6 \text{ exponents.} \\ 2. & 6. & 18. & 54. & 162. & 486. & 1458 \text{ terms in Geo.} \end{cases}$ Prog. then $5+5+5+6=21$ or 22d, or last term.

$$\frac{486\times486}{2}\times486=\frac{118098\times486}{2}=28697814, \text{ and}$$

$$\frac{28697814\times1458}{2}=20920706406$$ last term, from this take 2, the first term gives 20920706404, this divided by $3-1=2$, is = 10460353202, this added to 20920706406 = 31381059608 pins, which, at 100 for a farthing, gives 313810596 farthings=326886*l.* 0*s.* 9*d.* what the lace was sold for. Again, 22*yds.*×£7.=£154. what the lace cost; then 326886*l.* 0*s.* 9*d.*−£154. = 326732*l.* 0*s.* 9*d.* gain, *Ans.*

Note. As our author has not taken any notice of decreasing geometrical series, by which many curious ques-

tions may be solved, we shall therefore in this place give the following rule for solving of questions of this kind, with a few examples.

RULE. Divide the square of the first or greatest term, by the difference between the said first term and the second term in the series, and the quotient is the sum of the infinite progression in finite terms.

EXAMPLES.

(1) Required the sum of the infinite geometrical series $1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+$&c. ad infinitum.

By the rule $\frac{1\times1}{1-\frac{1}{2}}=\frac{1}{\frac{1}{2}}=1\times\frac{2}{1}=2$, sum required, *Ans.*

(2) Required the sum of infinite geometrical series $\frac{1}{3}+\frac{1}{9}+\frac{1}{27}+\frac{1}{81}+\frac{1}{243}+$&c.

$\frac{\frac{1}{3}\times\frac{1}{3}}{\frac{2}{9}}=\frac{1}{9}\div\frac{2}{9}=\frac{1}{9}\times\frac{9}{2}=\frac{9}{18}=\frac{1}{2}=$sum required, *Ans.*

(3) Suppose a body to move 14 miles the first hour, 12 the second hour, $10\frac{2}{7}$ the third hour, &c. in the same geometrical progression, would it ever arrive at a city 100 miles distant from a place it first set out at; were it possible it could move to infinity, and never stop.

RULES.

Then $\overline{14\times14}\div\overline{14-12}=196\div2=98$ miles, the utmost distance it could go; so that it would never reach the said city, *Ans.*

PERMUTATION.

(1) $1\times2\times3\times4\times5\times6\times7\times8\times9\times10\times11\times12=$ 479001600=number of changes, which divided by 10= 47900160 minutes=798336 hours=91 years 630 hours= 91 *yrs. 3we. 5da. 6ho. Ans.*

(2) $1\times2\times3\times4\times5\times6\times7=5040$ days, *Ans.*

N 2

PART II.

VULGAR FRACTIONS.

REDUCTION OF VULGAR FRACTIONS.

CASE I.

(1) Here by the rule $\left.\begin{array}{r} 2\times 7=14 \\ 4\times 4=16 \end{array}\right\}$ the new numerators for $\left\{\begin{array}{l} \frac{2}{4} \\ \frac{4}{7} \end{array}\right.$

$4\times 7=28$ the common denominator.

Therefore the new equivalent fractions are $\frac{14}{28}$ and $\frac{16}{28}$, *Ans.*

(2) Here $\left.\begin{array}{r} 1\times 4\times 8=32 \\ 3\times 2\times 8=48 \\ 5\times 2\times 4=40 \end{array}\right\}$ new numerators for $\left\{\begin{array}{l} \frac{1}{2} \\ \frac{3}{4} \\ \frac{5}{8} \end{array}\right.$

$2\times 4\times 8=64$ common denominator.

Then $\frac{32}{64}$, $\frac{48}{64}$, and $\frac{40}{64}$, *Ans.*

(3) Here $\left.\begin{array}{r} 7\times 6\times 10\times 7=2940 \\ 4\times 8\times 10\times 7=2240 \\ 6\times 8\times 6\times 7=2016 \\ 6\times 8\times 6\times 10=2880 \end{array}\right\}$ new numerators for $\left\{\begin{array}{l} \frac{7}{8} \\ \frac{4}{6} \\ \frac{6}{10} \\ \frac{6}{7} \end{array}\right.$

$8\times 6\times 10\times 7=3360$ common denominator.

Then $\frac{2940}{3360}$, $\frac{2240}{3360}$, $\frac{2016}{3360}$, and $\frac{2880}{3360}$, *Ans.*

(4) Here $\left.\begin{array}{r} 6\times 4\times 7\times 6=1008 \\ 2\times 10\times 7\times 6=840 \\ 1\times 10\times 4\times 6=240 \\ 3\times 10\times 4\times 7=840 \end{array}\right\}$ new numerators for $\left\{\begin{array}{l} \frac{6}{10} \\ \frac{2}{4} \\ \frac{1}{7} \\ \frac{3}{6} \end{array}\right.$

$10\times 4\times 7\times 6=1680$ common denominator.

Then $\frac{1008}{1680}$, $\frac{840}{1680}$, $\frac{240}{1680}$, and $\frac{840}{1680}$, *Ans.*

(5) Here $\left.\begin{array}{r} 4\times 3\times 7\times 8=672 \\ 2\times 5\times 7\times 8=560 \\ 3\times 5\times 3\times 8=360 \\ 1\times 5\times 3\times 7=105 \end{array}\right\}$ new numerators for $\left\{\begin{array}{l} \frac{4}{5} \\ \frac{2}{3} \\ \frac{3}{7} \\ \frac{1}{8} \end{array}\right.$

$5\times 3\times 7\times 8=840$ common denominator.

Then $\frac{672}{840}$, $\frac{560}{840}$, $\frac{360}{840}$, and $\frac{105}{840}$, *Ans.*

(6) Here $2\times9\times8\times5=720$, $5\times6\times8\times5=1200$, $2\times6\times9\times5=540$, $3\times6\times9\times8=1296$ } new numerators for $\left\{\frac{2}{6}, \frac{5}{9}, \frac{2}{8}, \frac{3}{5}\right.$

$6\times9\times8\times5=2160$ common denominator.

Then $\frac{720}{2160}$, $\frac{1200}{2160}$, $\frac{540}{2160}$, and $\frac{1296}{2160}$, *Ans.*

CASE II.

```
(7)   24)32(1
         24
         --
com. mea. 8)24(3
            24      24/32 ÷ 8 = 3/4, Ans.
            --
            ..
```

```
(8)   30)125(4
         120
         ---
com. mea.  5)30(6     30/125 ÷ 5 = 6/25, Ans.
             30
             --
             ..
```

```
(9)   208)684(3
          624
          ---
         60)208(3
            180
            ---
            28(60(2
               56
               --
com. mea.      4)28(7
                 28
                 --    208/684 ÷ 4 = 52/171, Ans.
                 ..
```

(10) 192)576(3
576
———
...

$\frac{192}{576} \div 197 = \frac{1}{3}$, *Ans.*

(11) 825)960(1
825
———
135)825(6
810
———
com. mea. 15)135(9
135
———
...

$\frac{825}{960} \div 15 = \frac{55}{64}$, *Ans.*

(12) 5184)6912(1
5184
———
com. mea. 1728)5184(3
5184
———
....

$\frac{5184}{6912} \div 1728 = \frac{3}{4}$, *Ans.*

CASE III.

(13) $\frac{\overline{18 \times 7} + 3}{7} = \frac{126 + 3}{7} = \frac{129}{7}$, *Ans.*

(14) $\frac{\overline{56 \times 22} + 13}{22} = \frac{1232 + 13}{22} = \frac{1245}{22}$, *Ans.*

(15) $\frac{\overline{183 \times 21} + 5}{21} = \frac{3843 + 5}{21} = \frac{3848}{21}$, *Ans.*

(16) $\frac{\overline{13 \times 5} + 4}{5} = \frac{65 + 4}{5} = \frac{69}{5}$, *Ans.*

(17) $\frac{\overline{27 \times 9} + 2}{9} = \frac{243 + 2}{9} = \frac{245}{9}$, *Ans.*

(18) $\frac{\overline{514 \times 16} + 5}{16} = \frac{8224 + 5}{16} = \frac{8229}{16}$, *Ans.*

CASE IV.

(19) $129 \div 7 = 18\frac{3}{7}$, *Ans.*

(20) $\frac{1245}{22} = 56\frac{13}{22}$, *Ans.*

(21) $3848 \div 21 = 183\frac{5}{21}$, *Ans.*

(22) $69 \div 5 = 13\frac{4}{5}$, *Ans.*

(23) $245 \div 9 = 27\frac{2}{9}$, *Ans.*

(24) $8229 \div 16 = 514\frac{5}{16}$, *Ans.*

CASE V.

(25) $\frac{2}{3} \times \frac{3}{5} \times \frac{5}{8} = \frac{30}{120} = \frac{5}{20} = \frac{1}{4}$, *Ans.*

(26) $\frac{5}{9} \times \frac{4}{7} \times \frac{11}{12} = \frac{220}{756} = \frac{55}{189}$, *Ans.* $\frac{143}{232}$

(27) $\frac{11}{12} \times \frac{13}{14} \times \frac{21}{29} = \frac{3003}{4872} = \frac{1001}{1624} = \frac{143}{232}$, *Ans.*

(28) $\frac{3}{4} \times \frac{5}{6} \times \frac{9}{10} = \frac{135}{240} = \frac{9}{16}$, *Ans.*

(29) $\frac{4}{5} \times \frac{6}{8} \times \frac{7}{9} = \frac{168}{360} = \frac{7}{15}$, *Ans.*

(30) $\frac{2}{7} \times \frac{5}{9} \times \frac{8}{10} = \frac{80}{630} = \frac{8}{63}$, *Ans.*

CASE VI.

(31) $\frac{7}{8} \times \frac{1}{12} \times \frac{1}{20} = \frac{7}{1920}$, *Ans.*

(32) $\frac{1}{4} \times \frac{1}{12} \times \frac{1}{20} = \frac{1}{960}$, *Ans.*

(33) $\frac{4}{5} \times \frac{1}{20} \times \frac{1}{12} = \frac{4}{1200}$ *Ans.*

(34) $\frac{4}{7} \times \frac{1}{28} \times \frac{1}{4} = \frac{4}{784}$, *Ans.*

CASE VII.

(35) $\frac{7}{1920} \times \frac{20}{1} \times \frac{12}{1} = \frac{1680}{1920} = \frac{168}{192} = \frac{21}{24} = \frac{7}{8}$, *Ans.*

(36) $\frac{1}{960} \times \frac{20}{1} \times \frac{12}{1} = \frac{240}{960} = \frac{24}{96} = \frac{3}{12} = \frac{1}{4}$, *Ans.*

(37) $\frac{4}{1200} \times \frac{12}{1} \times \frac{20}{1} = \frac{960}{1200} = \frac{96}{120} = \frac{8}{10} = \frac{4}{5}$, *Ans.*

(38) $\frac{4}{784} \times \frac{4}{1} \times \frac{28}{1} = \frac{448}{784} = \frac{56}{98} = \frac{8}{14} = \frac{4}{7}$, *Ans.*

CASE VIII.

(39) As 2 : 3 : : 12 : 18, then is $\frac{12}{18}$, *Ans.*

(40) As 5 : 7 : : 25 : 35, then is $\frac{25}{35}$, *Ans.*

(41) As 5 : 7 : : 47 : $65\frac{4}{5}$, then is $\frac{47}{65\frac{4}{5}}$, *Ans.*

CASE IX.

(42) As 3 : 2 : : 18 : 12, then is $\frac{12}{18}$, *Ans.*

(43) As 7 : 5 : : 35 : 25, then is $\frac{25}{35}$, *Ans.*

(44) As 7 : 5 : : $65\frac{4}{5}$: 47, then is $\frac{47}{65\frac{4}{5}}$, *Ans.*

CASE X.

(45) $\frac{\overline{36\times3}+2}{48\times3}=\frac{108+2}{144}=\frac{110}{144}=\frac{55}{72}$, *Ans.*

(46) $\frac{\overline{23\times7}+5}{38\times7}=\frac{161+5}{266}=\frac{166}{266}=\frac{83}{133}$, *Ans.*

(47) $\frac{47\times5}{\overline{65\times5}+4}=\frac{235}{325+4}=\frac{235}{329}=\frac{5}{7}$, *Ans.*

(48) $\frac{19\times3}{\overline{44\times3}+1}=\frac{57}{133}=\frac{3}{7}$, *Ans.*

CASE XI.

(49) $\frac{3}{4}\times\frac{20}{1}=\frac{60}{4}=15s.$ *Ans.*

(50) $\frac{2}{5}\times\frac{12}{1}=\frac{24}{5}=4\frac{4}{5}d.=4\frac{16}{5}d.=4\frac{3}{4}d.\ \frac{1}{5}$, *Ans.*

(51) $\frac{4}{7}\times\frac{16}{1}=\frac{64}{7}=9\frac{1}{7}oz.=9oz.\ 2\frac{2}{7}dr.$ *Ans.*

(52) $\frac{7}{9}\times\frac{4}{1}=\frac{28}{9}=3\frac{1}{9}qrs.=3qrs.\ 3\frac{1}{9}lb.=3qrs.\ 3lb.\ 1\frac{7}{9}oz.$ $=3qrs.\ 3lb.\ 1oz..\ 12\frac{4}{9}dr.$ *Ans.*

(53) $\frac{3}{5}\times\frac{12}{5}=\frac{36}{5}=7\frac{1}{5}oz.=7oz.\ 4dwts.$ *Ans.*

(54) $\frac{5}{9}\times\frac{5}{1}=\frac{25}{9}=2\frac{7}{9}qrs.=2qrs.\ 3\frac{1}{9}nls.$ *Ans.*

(55) $\frac{4}{5}\times\frac{8}{1}=\frac{32}{5}=6\frac{2}{5}fur.=6\,fur.\ 16\,po.$ *Ans.*

(56) $\frac{5}{8}\times\frac{4}{1}=\frac{20}{8}=2\frac{1}{2}ro.=2ro.\ 20\,po.$ *Ans.*

(57) $\frac{6}{7}\times\frac{63}{1}=\frac{378}{7}=54\ gal.$ *Ans.*

(58) $\frac{3}{9}\times\frac{36}{1}=\frac{108}{9}=12\ gal.$ *Ans.*

(59) $\frac{5}{12}\times\frac{36}{1}=\frac{180}{12}=15\ bush.$ *Ans.*

(60) $\frac{3}{5}\times\frac{4}{1}=\frac{12}{5}=2\frac{2}{5}we.=2we.\ 2\frac{4}{5}da.=2we.\ 2da.\ 19\frac{1}{5}ho.$ $=2we.\ 2da.\ 19ho.\ 12min.$ *Ans.*

CASE XII.

(61) $\frac{15}{1}s. \times \frac{1}{20} = \frac{15}{20} = £\frac{3}{4}$, *Ans.*

(62) $\frac{\overline{4 \times 4} + 3\frac{1}{5}}{12 \times 4 \times 5} = \frac{19\frac{1}{5}}{48 \times 5} = \frac{96}{240} = \frac{8}{20} = \frac{2}{5}$, *Ans.*

(63) $\frac{\overline{9 \times 16 + 2\frac{2}{7}}}{16 \times 16} = \frac{146\frac{2}{7}}{256} = \frac{1024}{1792} = \frac{128}{224} = \frac{16}{28} = \frac{4}{7}$, *Ans.*

(64) $\frac{\overline{3 \times 28} + 3lb.\ 1oz.\ 12\frac{4}{9}dr.}{4 \times 28} = \frac{\overline{16 \times 87}lb.\ 1oz.\ 12\frac{4}{9}dr.}{112 \times 16} =$

$\frac{\overline{1393\,oz. \times 16} + 12^{4}\,dr.}{1792 \times 16} = \frac{22300\frac{4}{9}\,dr.}{28672} = \frac{\overline{22300 \times 9} + 4}{28672 \times 9} =$

$\frac{200704}{258048} = \frac{50176}{64512} = \frac{25088}{32256} = \frac{3136}{4032} = \frac{448}{576} = \frac{56}{72} = \frac{7}{9}$, *Ans.*

(65) $\frac{\overline{7 \times 20} + 4}{12 \times 20} = \frac{144}{240} = \frac{6}{10} = \frac{3}{5}$, *Ans.*

(66) $\frac{\overline{2 \times 4} + 3\frac{1}{9}}{5 \times 4} = \frac{11\frac{1}{9}}{20} = \frac{\overline{11 \times 9} + 1}{20 \times 9} = \frac{100}{180} = \frac{10}{18} = \frac{5}{9}$, *Ans.*

(67) $\frac{\overline{6 \times 40} + 16}{8 \times 40} = \frac{240 + 16}{320} = \frac{256}{320} = \frac{32}{40} = \frac{4}{5}$, *Ans.*

(68) $\frac{\overline{2 \times 40} + 20}{4 \times 40} = \frac{100}{160} = \frac{10}{16} = \frac{5}{8}$, *Ans.*

(69) $\frac{54}{1} \times \frac{1}{63} = \frac{54}{63} = \frac{6}{7}$, *Ans.*

(70) $\frac{12}{1} \times \frac{1}{36} = \frac{12}{36} = \frac{1}{3}$, *Ans.*

(71) $\frac{15}{1} \times \frac{1}{36} = \frac{15}{36} = \frac{5}{12}$, *Ans.*

(72) $\frac{\overline{2 \times 7} + 2}{4 \times 7} + 19hours\ \ 12min. = \frac{24 \times 16 \times 19\frac{1}{5}\,ho.}{28 \times 24} =$

$\frac{384 + 19\frac{1}{5}}{672} = \frac{\overline{403 \times 5} + 1}{672 \times 5} = \frac{2016}{3360} = \frac{252}{420} = \frac{42}{70} = \frac{3}{5}$, *Ans.*

ADDITION OF VULGAR FRACTIONS.

First multiply each of the fractions by some number that will make each of the denominators the same; or reduce them to the same denominator by Case I. in Reduction.

(1) $\frac{2}{3}+\frac{5}{7}=\overline{\frac{2}{3}\times 7}+\overline{\frac{5}{7}\times 3}=\frac{14+15}{21}=\frac{29}{21}=1\frac{8}{21}$, *Ans.*

(2) $\frac{3}{4}+\frac{2}{7}+\frac{5}{6}=\overline{\frac{3}{4}\times 21}+\overline{\frac{2}{7}\times 12}+\frac{5}{6}\times 14=\frac{63}{84}+\frac{24}{84}+\frac{70}{84}=\frac{157}{84}=1\frac{73}{84}$, *Ans.*

(3) $\frac{1}{5}+4\frac{1}{3}+\frac{2}{5}=\overline{\frac{1}{5}\times 3}+\overline{\frac{13}{3}\times 5}+\frac{2}{5}\times 3=\frac{3}{15}+\frac{65}{15}+\frac{6}{15}=\frac{74}{15}=4\frac{14}{15}$, *Ans.*

(4) $7\frac{2}{3}+\frac{2}{5}=7\frac{10}{15}+\frac{6}{15}=7\frac{16}{15}=8\frac{1}{15}$, *Ans.*

(5) $\frac{2}{7}+\overline{\frac{2}{3}\times\frac{3}{4}}=\frac{24}{84}+\frac{42}{84}=\frac{66}{84}=\frac{11}{14}$, *Ans.*

(6) $5\frac{2}{3}+6\frac{7}{8}+4\frac{1}{2}=5+6+4+\frac{16}{24}+\frac{21}{24}+\frac{12}{24}=15+\frac{49}{24}=17\frac{1}{24}$, *Ans.*

(7)

	s.	*d.*
$£\frac{3}{4}\times\frac{20}{1}=\frac{60}{4}=$	15	0
$\frac{5}{6}s.\times\frac{12}{1}=\frac{60}{6}=$	0	10
Ans.	15	10

(8)

	s.	*d.*
$£\frac{2}{3}\times\frac{20}{1}=\frac{40}{3}=13\frac{1}{3}s.=$	13	4
$\frac{1}{2}d.\times\frac{4}{1}=\frac{4}{2}$ $=$	0	$0\frac{1}{2}$
Ans.	13	$4\frac{1}{2}$

(9)

	oz.	*dwt.*	*gr.*
$\frac{3}{4}\times\frac{12}{1}=\frac{36}{4}=$	9	0	0
$\frac{1}{6}\times\frac{20}{6}=\frac{10}{3}=$	0	3	8
Ans.	9	3	8

(10)

	cwt.	*qr.*	*lb.*	*oz.*	*dr.*
$\frac{4}{5}\times\frac{20}{1}=\frac{80}{5}=$	16	0	0	0	0
$\frac{5}{6}\times\frac{16}{1}=\frac{80}{6}=$	0	0	0	13	$5\frac{1}{3}$
Sum	16	0	0	13	$5\frac{1}{3}$ *Ans.*

(11)

	bu.	*pe.*
$\frac{2}{3}\times\frac{36}{1}=\frac{72}{3}=$	24	0
$\frac{3}{4}\times\frac{4}{1}=\frac{12}{4}=$	0	3
Ans.	24	3

(12)

	in.	*b.c.*
$\frac{1}{6}\times\frac{36}{6}=\frac{36}{6}=$	6	0
$\frac{2}{3}\times\frac{3}{1}=\frac{6}{3}$ $=$	0	2
Ans.	6	2

SUBTRACTION OF VULGAR FRACTIONS.

(1) First $\frac{3}{4}\times\frac{7}{7}-\frac{5}{7}\times\frac{4}{4}=\frac{21-20}{28}=\frac{1}{28}$, *Ans.*

(2) First $\frac{3}{5}\times\frac{5}{8}=\frac{15}{40}=\frac{3}{8}$. $\frac{5}{6}-\frac{3}{8}=\frac{20}{24}-\frac{9}{24}=\frac{11}{24}$, *Ans.*

(3) $5\frac{2}{3}-\frac{9}{10}=5\frac{20}{30}-\frac{27}{30}=5\frac{20}{50}=\frac{170}{30}-\frac{27}{30}=\frac{143}{30}=4\frac{23}{30}$, *Ans.*

(4) $\frac{38}{47}-\frac{3}{5}=\frac{190}{235}-\frac{141}{235}=\frac{49}{235}$, *Ans.*

(5) $\frac{1}{7}\times\frac{2}{3}=\frac{2}{21}$, and $\frac{19}{20}-\frac{2}{21}=\frac{399}{420}-\frac{40}{420}=\frac{359}{420}$, *Ans.*

(6) $\frac{2}{3}\times\frac{3}{4}=\frac{6}{12}=\frac{1}{2}$, and $64\frac{1}{4}=\frac{2}{4}=63\frac{3}{4}$, *Ans.*

(7) £$\frac{3}{4}-\frac{3}{4}$*s.* = 15*s.* − 9*d.* = 14*s.* 3*d.* *Ans.*

(8) $\frac{2}{3}$*s.* − $\frac{1}{2}$*d.* = 8*d.* − $0\frac{1}{2}$*d.* = $7\frac{1}{2}$*d.* *Ans.*

	oz.	*dwts.*	*gr.*
(9) $\frac{3}{4}$*lb.* $\times\frac{12}{1}=\frac{36}{4}=$	9	0	0
$\frac{1}{6}$*oz.* $\times\frac{20}{1}=\frac{20}{6}=$	0	3	8
difference	8	16	16 *Ans.*

	cwt.	*qr.*	*lb.*	*oz.*	*dr.*
(10) $\frac{4}{5}$*ton* $\times\frac{20}{1}=\frac{80}{5}=$	16	0	0	0	0
$\frac{5}{6}\times\frac{16}{1}=\frac{80}{6}=$	0	0	0	13	$5\frac{1}{3}$
difference	15	3	27	2	$10\frac{2}{3}$

	bu.	*pe.*
(11) $\frac{2}{3}\times\frac{36}{1}=\frac{72}{3}=$	24	0
$\frac{3}{4}\times\frac{4}{1}=\frac{12}{4}=$	0	3
difference	23	1 *Ans.*

	in.	*in. b.c.*
(12) $\frac{1}{6}+\frac{36}{1}=\frac{36}{6}=$	6	0
$\frac{2}{3}\times\frac{3}{1}=\frac{6}{3}=$	0	2
difference	5	1 *Ans.*

MULTIPLICATION OF VULGAR FRACTIONS.

(1) $\frac{3}{4}\times\frac{3}{5}=\frac{9}{20}$, *Ans.* (2) $\frac{7}{9}\times\frac{2}{3}=\frac{14}{27}$, *Ans.*

(3) $48\frac{3}{5}\times13\frac{5}{6}=\frac{243}{5}\times\frac{83}{6}=\frac{20169}{30}=672\frac{9}{30}=672\frac{3}{10}$, *Ans.*

(4) $430\frac{6}{10}\times18\frac{3}{7}=\frac{4306}{10}\times\frac{129}{7}=\frac{555474}{70}=7935\frac{24}{70}$, *Ans.*

(5) $\frac{16}{21}\times\frac{3}{4}\times\frac{5}{7}\times\frac{4}{5}=\frac{960}{2940}=\frac{96}{294}=\frac{16}{49}$, *Ans.*

(6) $\frac{9}{10}\times\frac{2}{3}\times\frac{3}{4}\times\frac{5}{6}=\frac{270}{720}=\frac{27}{72}=\frac{3}{8}$, *Ans.*

(7) $\frac{3}{4}\times\frac{2}{3}\times\frac{1}{3}\times\frac{2}{3}=\frac{12}{108}=\frac{1}{9}$, *Ans.* (8) $\frac{1}{4}\times\frac{3}{8}\times\frac{5}{7}=\frac{15}{224}$, *Ans.*

(9) $5\frac{6}{7}\times\frac{5}{6}=\frac{41}{7}\times\frac{5}{6}=\frac{205}{42}=4\frac{37}{42}$, *Ans.* (10) $\frac{24}{1}\times\frac{2}{3}=\frac{48}{3}=16$, *Ans.*

(11) $\frac{3}{4}\times\frac{9}{1}\times\frac{7}{8}=\frac{184}{32}=5\frac{29}{32}$, *Ans.* (12) $9\frac{1}{2}\times\frac{2}{6}=\frac{19}{6}=3\frac{1}{6}$, *Ans.*

DIVISION OF VULGAR FRACTIONS.

(1) $\frac{9}{20}\div\frac{3}{5}=\frac{9}{20}\times\frac{5}{3}=\frac{45}{60}=\frac{3}{4}$, *Ans.*

(2) $\frac{14}{27}\div\frac{2}{3}=\frac{14}{27}\times\frac{3}{2}=\frac{42}{54}=\frac{7}{9}$, *Ans.*

(3) $672\frac{9}{30}\div13\frac{5}{6}=\frac{20169}{30}\times\frac{6}{83}=\frac{121014}{2490}=48\frac{1494}{2490}=48\frac{3}{5}$ *Ans.*

(4) $7935\frac{24}{70}\div18\frac{3}{7}=\frac{555474}{70}\times\frac{7}{129}=\frac{3888318}{9030}=430\frac{5418}{9030}$ $=430\frac{3}{5}$, *Ans.*

(5) $\frac{3}{8}\div\overline{\frac{2}{3}\times\frac{3}{4}\times\frac{5}{6}}=\frac{3}{8}\div\frac{30}{72}=\frac{3}{8}\times\frac{72}{30}=\frac{216}{240}=\frac{27}{30}=\frac{9}{10}$, *Ans.*

(6) $\overline{\frac{2}{3}\times\frac{16}{1}}\div\overline{\frac{5}{7}\times\frac{3}{4}}=\frac{32}{3}\div\frac{15}{28}=\frac{32}{3}\times\frac{28}{15}=\frac{896}{45}=19\frac{41}{45}$, *Ans.*

(7) $\overline{\frac{1}{2}\times\frac{2}{3}}\div\overline{\frac{2}{3}\times\frac{3}{4}}=\frac{2}{6}\div\frac{6}{12}=\frac{1}{3}\times\frac{2}{1}=\frac{2}{3}$, *Ans.*

(8) $9\frac{2}{12}\div\overline{\frac{1}{2}\times\frac{7}{1}}=\frac{110}{12}\div\frac{7}{2}=\frac{55}{6}\times\frac{2}{7}=\frac{110}{42}=\frac{55}{21}=2\frac{13}{21}$, *Ans.*

(9) $\frac{9}{16}\div4\frac{1}{2}=\frac{9}{16}\div\frac{9}{2}=\frac{9}{16}\times\frac{2}{9}=\frac{18}{144}=\frac{2}{16}=\frac{1}{8}$, *Ans.*

(10) $16\div24=\frac{16}{1}\times\frac{1}{24}=\frac{16}{24}=\frac{2}{3}$, *Ans.*

(11) $5205\frac{2}{10} \div \overline{\frac{4}{5} \times \frac{91}{1}} = \frac{52052}{10} \div \frac{364}{5} = \frac{52052}{10} \times \frac{5}{364} = \frac{260260}{3640} = \frac{13013}{182} = 71\frac{91}{182} = 71\frac{1}{2}$, *Ans.*

(12) $3\frac{1}{6} \div 9\frac{1}{2} = \frac{19}{6} \div \frac{19}{2} = \frac{19}{6} \times \frac{2}{19} = \frac{38}{114} = \frac{19}{57} = \frac{1}{3}$, *Ans.*

THE SINGLE RULE OF THREE DIRECT IN VULGAR FRACTIONS.

After the question is stated as in whole numbers, invert the first term or divisor, then proceed as in Multiplication.

(1) As $\frac{3}{4}$*yd.* : £$\frac{5}{8}$ :: $\frac{9}{10}$*yd.* : $\frac{5}{8} \times \frac{9}{10} \times \frac{4}{3} = \frac{180}{240} = \frac{18}{24} =$ £$\frac{3}{4}$ $=15$*s.* *Ans.*

(2) As $\frac{5}{6}$*yd.* : £$\frac{2}{3}$ :: $\frac{11}{12}$: $\frac{2}{3} \times \frac{11}{12} \times \frac{6}{5} = \frac{132}{180} =$ £$\frac{11}{15} =$ 14*s.* 8*d.* *Ans.*

(3) First 7*s.* 3*d.* $= 87$*d.* $= \frac{87}{240} =$ £$\frac{29}{80}$. As $\frac{3}{4}$*yd.* : £$\frac{29}{80}$ :: $10\frac{1}{3}$*yd.* $= \frac{31}{3}$: £$\frac{29}{80} \times \frac{31}{3} \times \frac{4}{3} =$ 4*l.* 19*s.* $10\frac{1}{2}$*d.* $\frac{2}{3}$, *Ans.*

(4) As $\frac{3}{4}$*s.* : $\frac{7}{8}$*lb.* :: $\frac{8}{9}$*s.* : $\frac{7}{8} \times \frac{8}{9} \times \frac{4}{3} = \frac{7 \times 4}{3 \times 9} = \frac{28}{27} = 1\frac{1}{27}$ *lb.* *Ans.*

(5) First $12\frac{2}{3}$*ells* $= \frac{38}{3}$*ells*. As $\frac{3}{5}$*ells* : £$\frac{1}{3}$ :: $\frac{38}{3}$*ells* : $\frac{1}{3} \times \frac{38}{3} \times \frac{5}{3} = \frac{190}{27} =$ 7*l.* 0*s.* $8\frac{3}{4}$*d.* $\frac{5}{9}$, *Ans.*

(6) First $12\frac{1}{2}$*yds.* $= \frac{25}{2}$. 15*s.* 9*d.* $= 189$*d.* $=$ £$\frac{63}{80}$. $48\frac{1}{4}$*yds.* $= \frac{193}{4}$*yds.* Then, as $\frac{25}{2}$*yds.* : £$\frac{63}{80}$ :: $\frac{193}{4}$: $\frac{63}{80} \times \frac{193}{4} \times \frac{2}{25} = \frac{24318}{8000} = \frac{12159}{4000} =$ 3*l.* 0*s.* $9\frac{1}{2}$*d.* $\frac{\ }{25}$, *Ans.*

(7) As $\frac{9}{10}$*cwt.* : $\frac{284}{1}$*s.* :: $7\frac{1}{2}$*cwt.* $= \frac{15}{2}$*cwt.* : $\frac{284}{1} \times \frac{15}{2} \times \frac{10}{9} = \frac{42600}{18} = \frac{7100}{3} = 2366$*s.* 8*d.* $= 118$*l.* 6*s.* 8*d.* *Ans.*

(8) First £$2\frac{4}{5} =$ £$\frac{14}{5}$. $10\frac{2}{7}$*yds.* $= \frac{72}{7}$. As $\frac{3}{1}$: $\frac{14}{5}$ :: $\frac{72}{7}$: $\frac{2}{5} \times \frac{72}{1} \times \frac{1}{3} = \frac{144}{15} =$ £$9\frac{9}{15} =$ £9*l.* 12*s.* 0*d.* *Ans.*

(9) As 1*qr.* : $£\frac{2}{3}$: : $\frac{3}{5}$ *ells* = 3*qrs*.. : $\frac{1}{1} \times £\frac{2}{3} \times \frac{3}{1} = \frac{6}{2} =$ £2. *Ans.*

(10) First $36\frac{7}{10}$*lb.* $= \frac{367}{10}$. 1*l.* 5*s.* $= £1\frac{1}{4} = £\frac{5}{4}$. As $\frac{1}{1}$: $£\frac{5}{4}$: : $\frac{367}{10}$: $\frac{1835}{40}$ = 45*l.* 17*s.* 6*d.* *Ans.*

(11) First $27\frac{3}{7}$*yds.* $\times 4 = \frac{192}{7} \times \frac{4}{1} = \frac{768}{7}$. 15*s.* $= \frac{15\frac{5}{8}}{20} = \frac{135}{160}$ $= £\frac{25}{32}$. Then, as 1*yd.* : $£\frac{25}{32}$: : $\frac{768}{7}$: $\frac{19200}{224} =$ 85*l.* 14*s.* $3\frac{1}{4}$*d.* $\frac{5}{7}$, *Ans.*

(12) First $3\frac{1}{2} \times 24\frac{3}{8} = \frac{7}{2} \times \frac{195}{8} = \frac{1365}{16}$ 6*s.* $0\frac{3}{4}$*d.* $= \frac{291}{960} =$ $£\frac{97}{320}$. Then, as 1*ell* : $£\frac{97}{320}$: : $\frac{1365}{16}$*ells* : $\frac{132405}{5120} = \frac{26481}{1024}$ = 25*l.* 17*s.* $2\frac{1}{4}$*d.* $\frac{15}{16}$, *Ans.*

THE SINGLE RULE OF THREE INVERSE IN VULGAR FRACTIONS.

(1) First $24\frac{1}{4}$*da.* $= \frac{97}{4}$ *da.* As $\frac{97}{4}$ *da.* : : $\frac{48}{1}$ *men* : : $\frac{192}{1}$ *da.* : $\frac{97}{4} \times \frac{48}{1} \times \frac{1}{192} = \frac{4656}{768} = \frac{582}{96} = \frac{291}{48} = 6\frac{3}{48}$ *men, Ans.*

(2) First $145\frac{1}{4}$*mi.* $= \frac{581}{4}$ *mi.* $6\frac{1}{2}$*cwt.* $= \frac{13}{2}$*cwt.* As 1*cwt.* : $\frac{581}{4}$*mi.* : : $\frac{13}{2}$*cwt.* : $\frac{581}{4} \times \frac{2}{13} = \frac{581}{26} = 22\frac{9}{26}$ *miles, Ans.*

(3) As $1\frac{1}{5}$ *yd.* $= \frac{6}{5}$: $3\frac{1}{4}$*yds.* $= \frac{13}{4}$: : $\frac{4}{5}$: $\frac{6}{5} \times \frac{13}{4} \times \frac{5}{4} = \frac{390}{80} =$ $\frac{39}{8} = 4\frac{7}{8}$*yds.* *Ans.*

(4) As $\frac{3}{1}$ *men* : $4\frac{1}{2}$ *hours* $= \frac{9}{2}$ *hour* : : $\frac{10}{1}$ *men* : $\frac{3}{1} \times \frac{9}{2} \times \frac{1}{10}$ $= \frac{27}{20} = 1\frac{7}{20}$ *hour, Ans.*

(5) As 7*oz.* : $5\frac{1}{2}$*s.* $= \frac{11}{2}$*s.* : : $2\frac{1}{2}$*oz.* $= \frac{5}{2}$: $\frac{7}{1} \times \frac{11}{2} \times \frac{2}{5} = \frac{154}{10}$*s.* $= 15\frac{4}{10}$*s.* = 15*s.* 4*d.* $\frac{4}{5}$, *Ans.*

(6) As $1\frac{1}{2}$*yd.* $= \frac{3}{2}$: $7\frac{1}{2}$*yds.* $= \frac{15}{2}$: : $\frac{3}{4}$*yd.* : $\frac{3}{2} \times \frac{15}{2} \times \frac{4}{3} = \frac{180}{12}$ = 15*yds.* *Ans.*

THE DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

(1) First $£2\frac{1}{10}=£\frac{21}{10}$. 7*cwt.* $3\frac{1}{2}$*qrs.*$=31\frac{1}{2}$*qrs.*$=\frac{63}{8}$*cwt.* As $\frac{3}{1}$*cwt.* : $£\frac{21}{10}$: : $\frac{63}{8}$*cwt.* : $\frac{21}{10}\times\frac{63}{8}\times\frac{1}{3}=£\frac{1323}{240}=£\frac{441}{80}$. As $\frac{150}{1}$*mi.* : $£\frac{441}{80}$: : $\frac{50}{1}$*mi.* : $\frac{441}{80}\times\frac{50}{1}\times\frac{1}{150}=\frac{441}{80}\times\frac{1}{3}=\frac{441}{240}=\frac{147}{80}=£1\frac{67}{80}=1l.\ 16s.\ 9d.$ *Ans.*

(2) As $£\frac{6}{1}$: $£\frac{100}{1}$: : $£3\frac{3}{8}=\frac{27}{8}$: $\frac{100}{1}\times\frac{27}{8}\times\frac{1}{6}£\frac{2700}{48}=\frac{675}{12}=£\frac{225}{4}$. Again, as $\frac{12}{1}$*mo.* : $£\frac{225}{4}$: : $\frac{9}{1}$*mo.* : $\frac{12}{1}\times\frac{225}{4}\times\frac{1}{9}=\frac{900}{4\times3}=\frac{225}{3}=£75$, *Ans.*

(3) First, $£10\frac{7}{9}=£\frac{97}{9}$. As $\frac{9}{1}$*stud* : $£\frac{97}{9}$: : $\frac{20}{1}$*stud.* : $\frac{97}{9}\times\frac{20}{1}\times\frac{1}{9}=£\frac{1940}{81}$. Again, as $\frac{1}{1}$ *da.* : $£\frac{1940}{81}$: : $\frac{30}{1}$*da.* : $\frac{1940}{81}\times\frac{30}{1}\times\frac{1}{18}=\frac{9700}{81}\times\frac{1}{3}=39l.\ 18s.\ 4d.\ \frac{60}{243}$, *Ans.*

(4) First $4\frac{5}{8}s.=\frac{37}{8}s.=£\frac{37}{160}$. As 1*da.* : $£\frac{37}{160}$: : $10\frac{1}{2}$*da.* : $\frac{37}{160}\times\frac{10\frac{1}{2}}{1}=\frac{37}{160}\times\frac{21}{2}=£\frac{777}{320}$. Again, as $\frac{2}{1}$: $£\frac{777}{320}$: : $\frac{4}{1}$: $\frac{777}{320}\times\frac{4}{1}\times\frac{1}{2}=\frac{3108}{640}£\frac{777}{160}=4l.\ 17s.\ 1\frac{1}{2}d.$ *Ans.*

(5) As $£\frac{50}{1}$: $\frac{5}{1}$*mo.* : : $£13\frac{1}{3}=£\frac{40}{3}$: $\frac{50}{1}\times\frac{5}{1}\times\frac{3}{40}=\frac{750}{40}=\frac{75}{4}$*mo.* Again, as $£2\frac{37}{144}=£\frac{325}{144}$: $\frac{75}{4}$*mo.* : : $£1\frac{1}{12}=£\frac{13}{12}$: $\frac{75}{4}\times\frac{13}{12}\times\frac{144}{325}=\frac{75}{4}\times\frac{12}{25}=\frac{900}{100}=9$*mo.* *Ans.*

(6) First, as $\frac{20}{1}$*miles* : $\frac{60}{1}$*cwt.* : : $\frac{30}{1}$*miles* : $\frac{20}{1}\times\frac{60}{1}\times\frac{1}{30}=\frac{2000}{30}=40$*cwt.* Again, as $£14\frac{1}{2}=£\frac{29}{2}$: $\frac{40}{1}$*cwt.* : : $£5\frac{7}{16}=\frac{87}{16}$: $\frac{40}{1}\times\frac{87}{16}\times\frac{2}{29}=\frac{6960}{464}=\frac{1740}{116}=\frac{435}{29}=15$*cwt.* *Ans.*

PART III.

DECIMAL FRACTIONS.

ADDITION OF DECIMALS.

(1)
72,5
32,071
2,1574
371,4
2,75
Sum 480,8784.

(2)
30,07
2,0071
59,432
7,1
Sum 98,6091.

(3)
3,5
47,25
927,01
2,0073
1,5
Sum 981,2673.

(4)
52,75
47,21
724,0
31,452
0,3075
Sum 855,7195.

(5)
3275,0
27,514
1,005
725,0
7,32
Sum 4035,839.

(6)
27,5
52,0
3,2675
0,5741
2720,0
Sum 2803,3416.

SUBTRACTION OF DECIMALS.

(1)
0,2754
0,2371
rem. 0,0383

(2)
2,37
1,76
rem. 0,61

(3)
271,0
215,7
rem. 55,3

(4)
270,2
75,4075
rem. 194,7925

(5) 571,0	(6) 625,0	(7) 23,415	(8) 0,107
54,72	76,91	0,3742	0,0007
rem. 516,28	rem. 548,09	rem. 23,0408	rem. 0,1063

MULTIPLICATION OF DECIMALS.

(1) ,2365	(2) 2,071	(3) 27,15
,2435	2,27	25,3
,05758775 prod.	4,70117 prod.	686,895 prod.

(4) 72347,	(5) 17105,	(6) 17105,
23,15	,3257	,0237
167483,05 prod.	5571,0985 prod.	405,3885 prod.

(7) 27,35	(8) 57,21	(9) ,007
7,70071	,0075	,007
210,6144185 prod.	,0429075 prod.	,000049 prod.

(10) 20,15	(11) ,907
,2705	,0025
5,450575 prod.	,0022675 prod.

CONTRACTED MULTIPLICATION OF DECIMALS.

(12) 384,672 158
5 438,63

115401647
23080329
3077377
115402
15387
1923

Prod. 14169,2065

(13) 3,141592
8347,25

1570796
62831
21991
1257
94
25

Prod. 165,6994

(14) 2,38645
5712,8

190916
4773
239
167
12

Prod. 19,6107

(15) 375,13758
4237,61

37514
22508
2626
113
7
1

Prod. 6276,9

(16) 375,13758
4237,61

37513758
22508255
2625963
112541
7503
1500

Prod. 6276,9520

(17) 395,3756
24657,0

2767629
197688
23722
1582
79

Prod. 299,0700

DIVISION OF DECIMALS.

```
                            Quot.
(1) 6,321)85643,825(13549,09
          6321 ....
          -----
          22433
          18963
          -----
           34708
           31605
           -----
            31032
            25284
            -----
             57485
             56889
             -----
               59600
               56889
               -----
                2711
                ====
```

```
                  Quot.
(2) 144)48,0 (,333,&c.
        432
        ---
         480
         432
         ---
          480
          432
          ---
           48
          ===
```

```
                 Quot.
(3) 65)217,75(3,35
       195 ..
       ---
        227
        195
        ---
         325
         325
         ---
         ...
         ===
```

```
                            Quot.
(4) ,1045)125,0...(1196,172
          1045
          ----
           2050
           1045
           ----
           10050
            9405
            ----
             6450
             6270
             ----
              1800
              1045
              ----
               7550
               7315
               ----
                2350
                2090
                ----
                 260
                 ===
```

(5)
```
              Quot.
2,574),7090 (,27544
       5148
       ----
       19420
       18018
       -----
        14020
        12870
        -----
         11500
         10296
         -----
          12040
          10296
          -----
           1744
```

(6)
```
                     Quot.
8275)5,7140 (,00069
      49650
      -----
      74900
      74475
      -----
        425
```

(7)
```
                   Quot.
6,4252)7382,54 (1148,9976
       64252
       -----
       95734
       64252
       ------
       314820
       257008
       ------
        578120
        514016
        ------
         641040
         578268
         ------
          627720
          578268
          ------
           494520
           449764
           ------
            447560
            385512
            ------
             62048
```

(8)
```
                       Quot.
423),0851648 (,0002013
      846 . . .
      ---
       564
       423
       ----
       1418
       1269
       ----
        149
```

(9) Quot.

13,25)267,15975(20,163
2650....
2159
1325
8347
7950
3975
3975
....

(10) Quot.

,1347)72,1564(535,682
6735..
4806
4041
7654
6735
9190
8082
11080
10776
3040
2694
346

Quot.

(11) 30,75)715,00(23,25203
6150
10000
9225
7750
6150
16000
15375
6250
6150
10000
9225
775

(12) 5784÷10=578,4 quot.
(13) 5784÷100=57,84 quot.
(14) 5784÷1000=5,784 quot.
(15) 5784÷10000=,5784 quot.

CONTRACTED DIVISION.

Quot.

(16) 2,257432)721,17562(319,467
..... 677 2296

439460
225743

213717
203169

10548
9030

1518
1354

164
158

6

Quot.

(17) 5,2715|167)8,7586|15(1,6615
52715

34871
31629

3242
3163

79
53

26
26

..

```
                            Quot.
(18) 8,75860)51717591 (5904778,2
     ...... 43793000
            --------
             7924591
             7882740
            --------
               41851
               35035
              ------
                6816
                6131
                ----
                 685
                 613
                 ---
                  72
                  70
                 ---
                   2
                   2
                 ---
                   .
                 ===

                         Quot.
(19) 217,35)25,1367 (,11564
     .....21735
          -----
           3401
           2174
           ----
           1227
           1087
           ----
            140
            130
            ---
             10
              9
            ---
              1
            ===
```

```
                          Quot.
(20) ,1234150)51,47549(417,09255
     ....... 4936600
             -------
              210949
              123415
              ------
               87534
               86391
               -----
                1143
                1111
                ----
                  32
                  25
                  --
                   7
                   6
                   -
                   1
                   =
```

```
                      Quot.
(21) 7,9863)70,2300(8,7938
       .... 638904
            ------
             63396
             55904
             -----
              7492
              7187
              ----
               305
               239
               ---
                66
                63
                --
                 3
                 =
```

```
                Quot.
(22) 3,712)27,184 (7,3231
           25984
           -----
            1200
            1114
            ----
              86
              74
              --
              12
              11
              --
               1
               1
              --
               .
```

N.B. This method of contracting of Multiplication and Division will be found of excellent use to those who are employed in astronomical and other computations.

REDUCTION OF DECIMALS.

CASE I.

(1) $\frac{1}{4}=1,00\div4=,25=$decimal for $\frac{1}{4}$. For as 4 : 1 : : 1,00 : ,25.

(2) $\frac{1}{2}=1,0\div2=,5$ decimal for $\frac{1}{2}$. For as 2 : 1 : : 1,0 :,5.

(3) $\frac{3}{4}=3,00\div4=,75$ decimal for $\frac{3}{4}$. For as 4 : 3 : : 3,00 : ,75, &c.

(4) $\frac{3}{8}=3,000\div8=,375$ decimal required.

(5) $\frac{5}{26}=5,0000\div26=,192307+$decimal required.

(6) $\frac{11}{14}\times\frac{10}{13}=\frac{110}{182}=\frac{55}{91}=,6043956+$decimal required.

(7) $5s.=\frac{5}{20}=\frac{1}{4}=,25$, *Ans.* (8) $9s.=\frac{9}{20}=,45$, *Ans.*

(9) $16s.=\frac{16}{20}=\frac{4}{5}=,8$, *Ans.*

(10) $8s.\ 4d.=100d.=\frac{100}{240}=\frac{10}{24}=\frac{5}{12}=,416$, *Ans.* Or thus,

```
12|4
20|6233
   -----
   ,4166
```

(11)
$$\begin{array}{r|l} 4 & 3 \\ 12 & 7{,}75 \\ 20 & 16{,}64583 \end{array}$$

$16s.\ 7\frac{3}{4}d. = {,}8322916$, *Ans.*

(12)
$$\begin{array}{r|l} 2 & 1 \\ 12 & 5{,}5 \\ 20 & 19{,}4583 \end{array}$$

$19s.\ 5\frac{1}{2}d. = {,}972916$, *Ans.*

(13)
$$\begin{array}{r|l} 24 & 12 \\ 20 & 0{,}5 \\ 12 & 0{,}025 \end{array}$$

12 *gr.* = 0,002083, *Ans.*

(14) *dr.*
$$\begin{array}{r|l} 16 & 12 \\ 16 & 0{,}75 \end{array}$$

0,046875, *Ans.*

(15)
$$\begin{array}{r|l} 28 & 14 \\ 4 & 2{,}5 \end{array}$$

0,625, *Ans.*

(16)
$$\begin{array}{r|l} 8 & 2 \\ 3 & 0{,}25 \end{array}$$

0,0833, *Ans.*

(17)
$$\begin{array}{r|l} 2 & 1 \\ 4 & 2{,}5 \end{array}$$

0,625, *Ans.*

(18)
$$\begin{array}{r|l} 4 & 2 \\ 63 & 4{,}5 \end{array}$$

,0714285 + *Ans.*

(19)
$$\begin{array}{r|l} 4 & 1 \\ 36 & 2{,}25 \end{array}$$

,0625, *Ans.*

(20) 52 *days* $= \frac{52}{365} =$,1424657 + *Ans.*

CASE II.

(21) ,8322916 × 20 × 12 × 4 = 16*s.* ,645832 × 12 × 4 = 16*s.* 7*d.* ,749984 × 4 = 16*s.* $6\frac{1}{2}d.$,9, *Ans.*

(22) ,002084 × 12 × 20 × 24 = ,025008 × 20 × 24 = ,50016 × 24 = 12,00384 *grains*, *Ans.*

(23) ,46875 × 16 × 16 = 12 *drams*, *Ans.*

(24) ,625 × 4 = 2 *qrs.* 5 = 2 *qrs.* 14*lb.* *Ans.*

(25) ,625 × 4 = 2 *qrs.* 5 = 2 *quarts* 1 *pint*, *Ans.*

(26) ,071428 × 63 × 4 = 4,4999*gal.* = 4*gal.* 2 *qu.* nearly, *Ans.*

(27) ,0625 × 36 × 4 = 2 *gal.* ,25 = 2 *gal.* 1 *qu.* *Ans.*

(28) ,142465 × 365 = 51,999725 *days*. Or 52 *days*, nearly, *Ans.*

THE RULE OF THREE IN DECIMALS.

(1) First, as 26,5 *yards* : 3*l.* 16*s.* 3*d.*=£3,8125 :: 32,25 *yds.* : $\frac{3,1825 \times 32,25}{26,5}$ =24,590625÷5,3=£4,63974 =4*l.* 12*s.* 9½*d.* *Ans.*

(2) As 1 *man* : £1,275 :: 540 *men* : 540×1,275= £688,5=688*l.* 10*s.* *Ans.*

(3) As 7,75*yds.* : £2,6375 :: 140,5*yds.* $\frac{2,6375 \times 140,5}{7,75}$ = $\frac{14,82275}{,81}$ =£47,81532=47*l.* 16*s.* 3½*d.* ,7, *Ans.*

(4) As 7,625 *cwt.* : £36,6375 :: 2,4375 *cwt.* : $\frac{36,6375 \times 2,4375}{7,625} = \frac{36,6375 \times ,0195}{,061}$ =£11,71198= 11*l.* 14*s.* 2¾*d.* ,5, *Ans.*

(5) First, 24 *tons* 12*cwt.* 2*qrs.* 14*lb.* 12*oz.*=882796 *oz.* 3678*l.* 6*s.* 4*d.*=£3678,316. As 882796*oz.* : £3678,316 :: 1*oz.* : $\frac{3678,316}{882796}$ =£00417=1*d.*+*Ans.*

(6) First 3*s.* 6*d.*=£,175. As 1,5*lb.* : £,175 :: 326,25*lb.* : $\frac{326,25 \times ,175}{1,5}$ =217,5×,175=£38,0625=38*l.*1*s.*3*d.Ans.*

(7) As 1*oz.* =480*gr.* : £2,95 :: 9197*gr.*: $\frac{9197 \times 2,95}{480}$ =56*l.* 10*s.* 5½*d.*+*Ans.*

(8) As 1*yd.* : 10½*d.*=£,04375 :: 827,75*yds.* : £36,2141 =36*l.* 4*s.* 3¼*d.* ,5, *Ans.*

(9) Inversely, As ⅝*year*=,625 : £34 :: $\frac{5}{12}$*year*=,416 : £51, *Ans.*

(10) Inversely, As 2,25 *yards* : ,75 *yards* :: ,8 *yards* : 2,109375 *yards*, *Ans.*

(11) As 1*oz.*=480 *gr.* : 5*s.* 6*d.*=£,275 :: 10804 *gr.* : £6,18979=6*l.* 3*s.* 9½*d.* ,2, *Ans.*

(12) As 1*lb.* : 15*d.*=£,0625 : : 15*cwt.* 1*qr.* 27*lb.* = 1727*lb.* : £107,9375=£107*l.* 18*s.* 9*d.* *Ans.*

(13) As 112*lb.* : 2*l.* 9*s.* 6*d.*=£2,475 : : 45*cwt.* 3*qrs.* 14*lbs.*=5138*lbs.* : $\frac{5138\times2,475}{112}$ = £113,540625 = £113. 10*s.* 9$\frac{3}{4}$*d.* *Ans.*

(14) First 6*cwt.* 3*qrs.*×6=40,5*cwt.* As 1*cwt.* : £2,8 : : 40,5*cwt.* : 40,5×2,8=£113,4=113*l.* 8*s.* 0*d.* *Ans.*

(15) As 5*s.* 4*d.*=£.26 : 1*oz.* : : £10,6 : $\frac{10,6}{,26}$=39,75*oz.* =39*oz.* 15*dwt.* *Ans.*

(16) As 25*cwt.* 3*qrs.* 14*lb.*=2898*lb.* : £187,1625 : : 1*lb.* : $\frac{187,1625}{2898}$=£,064583=1*s.* 3$\frac{1}{2}$*d.* *Ans.*

(17) As 29,25*lbs.* : £10,5625 : : 3*lbs.* : $\frac{10,5625\times3}{29,25}$ = $\frac{1,2675}{1,17}$=£1,083=1*l.* 1*s.* 8*d.* *Ans.*

(18) As 3,5*lb.* : 13*d.*=£,05416 : : 112*lb.* : £1,73= 1*l.* 14*s.* 8*d.* *Ans.*

EXTRACTION OF THE SQUARE ROOT.

(1) 119025(345, *Ans.*

```
      119025(345
      9
      ----
  64) 290
      256
      ----
 685) 3425
      3425
      ----
      ....
```

(2) 106929(327, *Ans.*

```
      106929(327
      9
      ----
  62) 169
      124
      ----
 647) 4529
      4529
      ----
      ....
```

(3) 2268741(1506,23+ *Ans.*
1

25) 126
125

3006) 18741
18036

30122) 70500
60244

301243) 1025600
903729

121871

(4) 7596796(2756,228+ *Ans*
4

47) 359
329

544) 3067
2725

5506) 34236
33036

55122) 126000
110244

551242) 1575600
1102484

5512448) 47311600
44099584

3212016

(5) 36372961 (6031, *Ans.*
36

1203) 3729
3609

1206) 12061
12061

.....

(6) 22071204 (4698, *Ans.*
16

86) 607
516

929) 9112
8361

9388) 75104
75104

.....

```
(7)   3271,4007 (57,196+Ans.
      25
      ---
   107)771
       749
       ------
   1141)2240
        1141
        ------
  11429)109907
        102861
        -------
  114386)704600
         686316
         ------
          18284
          ======

(8)   4795,257310(69,24779+Ans.
      36
      ---
   129)1195
       1161
       ------
   1382)3425
        2764
        -----
  13844)66173
        55376
        ------
 138487)1079710
         969409
        --------
 1384947)11030100
          9694629
         ---------
 13849549)133547100
          124645941
          ---------
            8901159
          =========
```

(9) 4,372594(2,091+*Ans.*
4
409) 3725
3681
4181)4494
4181
313

(10) 2,2710957(1,50701,*Ans.*
1
25)127
125
3007)21095
21049
301401)467000
301401
165599

(11)
,00032754 (,018098+*Ans.*
1
28)227
224
3609) 35400
32481
36188) 291900
289504
2396

(12)
1,270054=1,12696+*Ans.*
1
21) 27
21
222) 600
444
2246) 15654
13476
22529) 217800
202761
225386) 1503900
1352316
151584

(13) $\sqrt{\frac{2304}{5184}}=\sqrt{\frac{4}{9}}=\frac{2}{3}$, *Ans.* (14) $\sqrt{\frac{2704}{4225}}=\sqrt{\frac{16}{25}}=\frac{4}{5}$, *An[s].*

(15) $\overline{\frac{9216}{12544}}=\sqrt{\frac{36}{49}}=\frac{6}{7}$, *Ans.*

To extract the Square Root of Vulgar Fractions that are Surds.

(16) $\frac{275}{341}=\frac{25}{31}=,8064516129$, then $\sqrt{,8064516129}=$ $,89802+$ *Ans.*

(17) $=\frac{357}{476}=\frac{51}{68}=\frac{3}{4}=75$, then $\sqrt{,75}=,86602+$ *Ans.*

(18) $\frac{478}{549}=,870673952$, then $\sqrt{,8706739526}=,93309$ $+$ *Ans.*

OF MIXED NUMBERS.

(19) $51\frac{21}{25}=\frac{1296}{25}$, then $\sqrt{\frac{1296}{25}}=\frac{36}{5}=7\frac{1}{5}$, *Ans.*

(20) $27\frac{9}{16}=\frac{441}{16}$, then $\sqrt{\frac{441}{16}}=\frac{20}{4}=5\frac{1}{4}$, *Ans.*

(21) $9\frac{43}{49}=\frac{434}{49}$, then $\sqrt{\frac{484}{49}}=\frac{22}{7}=3\frac{1}{7}$, *Ans.*

SURDS.

(22) $85\frac{14}{15}=85,93$, then $\sqrt{85,93}=9,27+$ *Ans.*

(23) $8\frac{5}{7}=8,7142857$, then $\sqrt{8,7142857}=2,9519+$ *Ans.*

(24) $6\frac{2}{3}=6,6$, then $\sqrt{6,6}=2,58198+$ *Ans.*

To find a mean Proportional between any two Numbers.

(1) Here $\sqrt{3\times 12}=\sqrt{36}=6$ the mean proportional required.

(2) Here $\sqrt{4276\times 842}=\sqrt{3600392}=1897,4+$mean proportional required.

How to find the Side of a Square equal in Area to any Superficies.

(1) Here $\sqrt{160}=12,6491+$the side of the square required.

(2) Here $\sqrt{750}=27,38612$ the side of the square required.

The Area of a Circle given to find the Diameter.

(1) First, as 1 : 1,273239 : : 160 : 203,718240, then $\sqrt{203,718240}=14,272=$ diameter in perches; then $14,272\div 2=7,136+$the radius, from which deduct one perch for the length of the cow and tail, and we have 6,136 perches, *Ans.*

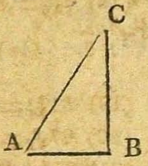
The Area of a Circle given to find the Periphery or Circumference.

(1) As 1 : 12,56637 : : 12 : 150,79644, then $\sqrt{150,79644}$ $=12,2798+=$circumference as required.

(2) As 1 : 12,56637 : : 160 : 2010,6192, then $\sqrt{2010,6192}$ $=44,839+$circumference, *Ans.*

The Base and Perpendicular given to find the Hypothenuse.

(1) Here $\overline{AB}|^2+\overline{BC}|^2=\overline{AC}|^2=\overline{60}^2+\overline{45}|^2=5625$, then $\sqrt{5625}=75=$hypothenuse, AC, length of the ladder required.



(2) Here $\overline{AB}|^2+\overline{BC}|^2=\overline{AC}|^2=\overline{30}^2+25^2=1525$, then $\sqrt{1525}=39,05=$AC$=$length of the ladder required.

Any Number of Men being given to form them into a square Battalia, to find the Number in Rank and File.

(1) Here $\sqrt{331776}=576$, the number of rank and file, *Ans.*

(2) Here $\sqrt{48841}=221$. number contained in one of the sides, *Ans.*

Another Method by which the Square Root may be very often expeditiously solved by the following Rule.

RULE.—First find the nearest square to the given number whose root is required; then say, as three times the nearest square, added to the given number : so three times the given number, added to the nearest square : : the root of the nearest square : the root required nearly.

EXAMPLE.—Let the square root of 150 be required.

144=nearest square, its root =12.

```
               3      150
             ———        3
By the rule 432      ————
            150       450
            ———       144
     As 582 :        ————
                      594 : : 12 : 12,247+root req. Ans.
```

EXTRACTION OF THE CUBE ROOT.

(1) 99252847 (463
64

$4^2 \times 3 = 48$)35252
33336

$46^2 \times 3 = 6348$) 1916847
1916847

....

Ans. 463 root.

216 = cube of 6.
432 = $4 \times 3 \times 6^2$
288

33336 subtrahend.

27 = cube of 3.
1242 = $46 \times 3 \times 3^2$
19044 = 6348×3

1916847 subtrahend.

(2) 389017 (73
343

$7^2 \times 147$)46017
46017

.....

27 = cube of 3
189
441

46017 subtrahend.

Ans. 73 the root.

(3) 5735339 (179
1

$1^2 \times 3 = 3$)4735
3913

$17^2 \times 3 = 867$)822339
822339

......

Ans. 179 root.

343 = cube of 7.
147
21

3913

729 = cube of 9.
4131
7803

822339

(4) 32461759(319
27

$3^2 \times 3 = 27$)5461
2791

$31^2 \times 3 = 2883$)2670759
2670759

....

1 = cube of 1.
9
27

2791

729 = cube of 9.
7533
25947

2670759

Ans. 319 the root.

(5) 84604519(439
64

$4^2 \times 3 = 48$)20604
15507

$43^2 \times 3 = 5547$)5097519
5097519

....

27 = cube of 3.
108
144

15507

729 = cube of 9.
10449
49923

5097519

Ans. 439 the root.

(6) 259694072(638
216

$6^2 \times 3 = 108$)43694
34047

$63^2 \times 3 = 11907$)9647072
9647072

....

27 = cube of 3.
162
324

34047

512 = cube of 8.
12096
95256

9647072

Ans. 638 the root.

(7) 48228544(364
27

$3^2 \times 3=27$)21228
19656

$\overline{36}|^2 \times 3=3888$)1572544
1572544

....

Ans. 364 the root.

216=cube of 6.
324
162

19656

64=cube of 4.
1728
15552

1572544

(8) 27054036008(3002
27

$\overline{300}^2 \times 3=270|000|$54036008
54036008

....

8=cube of 2.
3600
540000

54036008

Ans. 3002 the root.

(9) 22069810125(2805
8

$2^2 \times 3=12$)14069
13952

$\overline{28}^2 \times 3=2352|$117810125
$\overline{280}|^2 \times 3=235200|$117810125

....

Ans. 2805 the root.

512=cube of 8.
384
96

13952

125=cube of 5.
21000
1176000

117810125

(10) 122615327232(4968
64

$\overline{4})^2 \times 3 = 48$ div.)58615 resolvend.
53649 product subtract.

$\overline{49})^2 \times 3 = 7203$ div.)4966327 resolvend.
4374936 product subtract.

$\overline{496})^2 \times 3 = 738048$di.)591391232 resolvend.
591391232 product subtract.

....

$9 \times 9 = 81$ square of the last figure.
4881 square of last fig. put to the right of div.
$9 \times 3 \times 4 = 108$ triple of last fig. ×ed by the former.

$5961 \times 9 = 53649$ product subtract.

720336 square of the last fig. put to the right of divisor.
882 triple of the last figure ×ed by the former.

$729156 \times 6 = 4374936$ product subtract from resolvend.

73804864 square of the last fig. put to the right of div.
11904 triple of the last fig. ×ed by the former.

73923904
8

591391232 product to subtract from the resolvend.

Ans. 4968 the root.

(11) 219365327791 (6031
216

$6^2 \times 3 = 108$ | 3365327 resolvend.
$60^2 \times 3 = 10800$ | 3256227

$603^2 \times 3 = 1090827$ div.)109100791 resolvend.
109100791 product.

....

1080009 square of last fig. put to the right
triple of the last 540 × former. [of the divisor.

1085409
3 last fig.

3256227

109082701 square of the last, &c.
1809 triple of the last, &c.

109100791 product to subtract.

(12) 673373097125 (8765
512

$8^2 \times 3 = 192$ div.)161373 resolvend.
146503

$87^2 \times 3 = 22707$ div.)14860097
13718376

$876^2 \times 3 = 2302128$ div.)1151721125 resolvend.
1151721125 product.

....

19249 square of the last put to the right of the divisor.
168 . triple last ×ed by former.

20929 sum.
7

146503 product.

2270736 square of the last put to the right of the divisor.
1566 triple of the last by former.

2286396 sum.

13718376 product.

230212825 square of the last put to the right [of the divisor.
triple of last 13140

230344225 sum.
5

1151721125 product.

Ans. 8765 the root.

N.B. These three last questions are solved by our author's second rule.

(13) 12,977875(2,35
8

$\overline{2}^2 \times 3 = 12$)4977
4167

$\overline{23}^2 \times 3 = 529 \times 3 = 1587$ div.)810875
810875

......

27=cube of 3.
54 $=2\times3\times\overline{3}|^2$.
36 =divisor by the last figure.

4167 subtrahend.

125=cube of 5.
1725 $=23\times3\times\overline{5}|^2$.
7935 =divisor by the last.

810875 subtrahend.
Ans. 2,35 the root.

(14) 36155,027576 (33,06
27

$\overline{3}|^2\times3=27$)9155

27
81
81

8937

$\overline{33}|^2\times3=3267$)218027

$\overline{330}|^2\times3=336700$)218027576

216
35640
1960200

196376616

21650960, &c. rem.

Subtrahend.
$\overline{3}|^3=27$
$3\times3\times\overline{3}|^2=81$
$27\times3=81$

Subtrahend.
$\overline{6}|^3=216$
$330\times3\times\overline{6}|^2=35640$
$326700\times6=1960200$

(15) $\dot{0}01\dot{9}06\dot{6}24$ (,124

1

$\overline{1}|^2 \times 3 = 3$) 906

8
12
6

728

Subtrahend.
$\overline{2}|^3 = 8$
$1 \times 3 \times \overline{2}|^2 = 12$
$3 \times 2 = 6$

$\overline{12}|^2 \times 3 = 432$)178624

64
576
1728

178624

Subtrahend.
$\overline{4}|^4 = 64$
$12 \times 3 \times \overline{4}|^2 = 576$
$432 \times 4 = 1728$

(16) $3\dot{3},2\dot{3}09\dot{7}96\dot{3}7$ (32,15

27

$\overline{3}|^2 \times 3 = 27$) 6230

27
36
54

5787

Subtrahend.
$\overline{3}|^3 = 27$
$3 \times 3 \times \overline{2}|^2 = 36$
$27 \times 2 = 54$

$\overline{32}|^2 \times 3 = 3072$) 443979

1
96
3072

308161

Subtrahend.
$\overline{1}|^3 = 1$
$32 \times 3 \times \overline{1}|^2 = 96$
$3072 \times 1 = 3072$

$\overline{321}|^2 \times 3$)135818637

(17) 15926,972504 (25,16

8

$\overline{2}^2 \times 3 = 12)$ 7926

125

150

60

7625

Subtrahend.

$\overline{5}^3 = 125$

$2 \times 3 \times \overline{5}^2 = 150$

$12 \times 5 = 60$

$\overline{25}^2 \times 3 = 1875)$ 301972

1

75

1875

188251

Subtrahend.

$\overline{1}^3 = 1$

$25 \times 3 \times \overline{1}^2 = 75$

$1875 \times 1 = 1875$

$\overline{251}^2 \times 3 = 189003)$ 113721504

216

27108

567009

56972196

56749308 Rem.

Subtrahend.

$\overline{6}^3 = 216$

$251 \times 3 \times \overline{6}^2 = 27108$

$189003 \times 3 = 567009$

(18) ,053157376 (,376

27

———

$\overline{3}^2 \times 3 = 27$)26157

———

343

441

189

———

23653

———

$\overline{37}^2 \times 3 = 4107$)2504376

———

216

3996

24642

———

2504376

═══

Subtrahend.

$\overline{7}^3 = 343$

$3 \times 3 \times \overline{7}^2 = 441$

$27 \times 7 = 189$

Subtrahend.

$\overline{6}^3 = 216$

$37 \times 3 \times \overline{6}^2 = 3996$

$4107 \times 6 = 24642$

As the two following rules may be thought more expeditious than the rules given by our author, they are here inserted.

RULE 1.—Let the nearest root of the first period, whether greater or less than the truth, be taken, and thereto annex cyphers, to supply the vacancy of the remaining figures to be had in the root; divide the difference between four times the number to be extracted, and this root so ordered by thrice the said root, then the square root of the quotient added to the nearest root first taken will be equal to twice the required root; or this may be taken for a new operation, if more exactness be required.

RULE 2.—Find the nearest cube to the given number whose root is required; then say, as twice the nearest cube added to the given number : to twice the given number added to the nearest cube : : the root of the nearest cube : the root required; and if more exactness is required, let this root so found be used for the nearest, and its cube for the nearest cube, and proceed as before.

(19) By the first rule, 36155,027560(33=nearest root.
4

144620,110240=4 times given num.
$\overline{33}|^3$= 35937.=cube of the nearest root.

33×3=99, thrice nearest root } 99)108683,110240 difference.

quotient=. 1097,809194(33,133 square root.
9 add 33, =nearest root.

63) 197
189

661) 880
661

6623)21991
19869

66263) 212294
198789

13505

2)66,133 sum.

33,066+root req.

(20) By the first rule, ,001906624(,122 nearest root.
4

,007626496=4 times given num.
,001815848=cube of nearest rt.

thrice nearest root 366),005810648 difference.

quotient=,01587608743(,126 square root.
1 add ,122=nearest rt.

22) 58
44

246)1476
1476

....

2),248 sum.

Ans. ,124 root req.

(21) By the first rule, 33,230979937 (3,21 nearest root.
4

132,923919748 = 4 times giv. num.
33,076161 cube of nearest root.

thrice the nearest root } = 9,63)99,847758748

quotient = 10,36840693 (3,22 square root.
9 add 3,21 nearest root.

62) 136 2)6,43
124

3,215 + root req. *Ans.*

642) 1284
1284

....

(22) By the second rule, take 2,51 for the root of the nearest cube, then $\overline{2,51}|^3 \times 2 = 31626,502 + 15926,972504 = 47553,474504 : \overline{2,51}|^3 + 31853,945008 = 47667,196008 :: 25,1 : 25,16$ + root req. *Ans.*

(23) By the second rule, take ,37 for the root of the nearest cube, then $\overline{,37}|^3 \times 2 + ,053157376 : ,106314752 + \overline{,37}|^3 :: ,37 : ,376$ nearly,
Or nearer thus, take ,372 for the nearest root,
then, As $\overline{,372}|^3 \times 2 + ,053157376 : ,053157376 \times 2 + \overline{,372}|^3 :: ,372 : ,376$, *Ans.*

To extract the Cube Root of a Vulgar Fraction.

(24) First $\frac{250}{686} = \frac{125}{343}$ whose root is $\sqrt[3]{\frac{125}{343}} = \frac{\overline{125}|^{\frac{1}{3}}}{343} = \frac{5}{7}$, *Ans.*

(25) First, $\frac{324}{1500} = \frac{81}{375} = \frac{27}{125}$ whose root is $\sqrt[3]{\frac{27}{125}} = \frac{3}{5}$, *Ans.*

(26) First $\frac{1520}{5130} = \frac{152}{513} = \frac{8}{27}$ whose root is $\sqrt[3]{\frac{8}{27}} = \frac{2}{3}$, *Ans.*

SURDS.

(27) First $\frac{4}{7}$=,5714285, whose root is $\sqrt[3]{,5714285}$= ,829+ *Ans.*

(28) First $\frac{5}{9}$=,5, whose root is $\sqrt[3]{,5}$=,822+ *Ans.*

(29) First $\frac{2}{3}$=,6, whose root is $\sqrt[3]{,6}$=,873+ *Ans.*

To extract the Cube Root of a mixed Number.

(30) First $12\frac{19}{27}=\frac{343}{27}$, whose root is $\frac{7}{3}=2\frac{1}{3}$, *Ans.*
(31) First $31\frac{15}{343}=\frac{10648}{343}$, whose root is $\frac{22}{7}=3\frac{1}{7}$, *Ans.*
(32) First $405\frac{28}{125}=\frac{50653}{125}$, whose root is $\frac{37}{5}=7\frac{2}{5}$, *Ans.*

SURDS.

(33) First $7\frac{1}{5}$=7,2, whose root is $\sqrt[3]{7,2}$=1,93+ *Ans.*

(34) First $9\frac{1}{6}$=9,16, whose root is $\sqrt[3]{9,16}$=2,092+ *Ans.*

THE APPLICATION.

(1) First 47×47×47=103823, cubic inches, *Ans.*
(2) First 12×12×12=1728, cubic feet, *Ans.*

(3)	$\sqrt[3]{389017}$=73	27=cube of 3.
	343	189 =7×3×3^2
		441 =147×3
7^2×3=147 div.)	46017 resolv.	
	46017 subtra.	46017
	.....	

Then 73×73=5329 superficial content as required.

Between two Numbers given to find two mean Proportionals.

(4) First 162÷6=27, whose root is $\sqrt[3]{27}$=3, then 3× 6=18=least mean, and 18×3=54 the greater mean.

Ans. 18 and 54.

(5) First 108÷4=27, whose root is $\sqrt[3]{27}=3$, then $4\times 3=12$, the least mean, and $12\times 3=36$, the greater mean. *Ans.* 12 and 36.

For as 4 : 12 :: 36 : 108.

How to find the Side of a Cube that shall be equal in solidity to any given Solid, as a Globe, Cylinder, Prism, Cone, &c.

(6) $\sqrt[3]{10648}=22$ 8=cube of 2.

```
               8                      24
             ----                     24
2²×3=12 div.) 2648 resolv.           ----
               2648                   2648
              ----                   ----
              ....
              ====      Ans. 22, side required.
```

Having the Side of a Cube, to find the Side of another that shall be double, treble, &c. in solidity to that given.

(7) First $12\times 12\times 12=1728$, then $1728\times 3=5184$, the cube root of which is

$\sqrt[3]{5184}=17,306+$ 343=cube of 7.

```
              1                       147  =1×3×7²
            ----                      21
     1×3=3)4184 resolvend.           ----
            3913 subtrahend.          3913
           ------                    ----

17²×3=867) 271000
           264717                      27=cube of 3.
          ----------                  459
    8978700)  6283000000              2601
              5389088616             ------
             ------------            264717
               893911384             ------
             ------------
                         216=cube of 6.
                      186840  =1730×3×6²
                    53872200  =divisor by 6
                   ----------
                  5389088616
Ans. 17,306+      ==========
```

THE BIQUADRATE ROOT.

(1) First $27 \times 27 = 729$. $\overline{729}|^2 = 531441$, the biquadrate required, *Ans.*

(2) First $76 \times 76 = 5776$, then $5766 \times 5776 = 33362176$, biquadrate required, *Ans.*

(3) First $275 \times 275 = 75625$, then $\overline{75625}|^2 = 5719140625$, biquadrate required, *Ans.*

(4) First $\sqrt{531441} = 729$ square root.

```
          531441
          49
          ----
   142)   414
          284
          -----
   1449)  13041
          13041
          -----
          .....
          -----
```

Then $\sqrt{729} = 27$ = biquadrate root required, *Ans.*

```
      729
      4
      ---
  47) 329
      329
      ---
      ...
      ===
```

(5) First $\sqrt{33362176} = 5776$ square root.

```
          25
        ------
   107) 836
        749
        -------
  1147) 8721
        8029
        --------
 11546) 69276
        69276
        --------
        .....
        --------
```

Then $\sqrt{5776} = 76$, biquadrate root required, *Ans.*

```
       49
      -----
 146) 876
      876
      -----
      ...
      =====
```

(6) First $\sqrt{5719140625} = 75625$.

```
           49
          ------
     145) 819
          725
          --------
    1506) 9414
          9036
          --------
   15122) 37806
          30244
          ---------
  151245) 756225
          756225
          ---------
          ......
          ---------
```

Then $\sqrt[4]{75625}=275$, biquadrate root required, *Ans.*

```
       4
      ---
  47)356
     329
     ----
 545) 2725
      2725
      ----
      ....
```

HOW TO EXTRACT THE ROOTS OF ALL POWERS.

(1) First $\sqrt{141376}=376$

```
                       9
                      ---
3×2=6 div.)           51 dividend.        37×37=1369.
                      ---
                      1369 subtrahend.
                      ----
37×2=74 div.)         447 dividend.       376×376=
                      ----
                      141376 subtrahend.
                      ------
                      ......
```

Ans. the square root is 376.

(2) $\sqrt[3]{53157376}=376$

```
                          27
                          ---
3×3×3=27 div.)            261 dividend.
                          50653 subtrahend.
                          -----
37²×3=4107 div.)          25043 dividend.
                          53157376
                          --------
                          ........
```

$37\times37\times37=50653$.

$376\times376\times376=53157376$.

Then 376 is the cube root required, *Ans.*

(3) $\sqrt[4]{19987173376} = 376.$
81

$3^3 \times 4 = 108$ div.)1188 dividend.

1874161 subtrahend.

202612)1245563 dividend.

19987173376

....

$37 \times 37 \times 37 \times 37 = 1874161.$
$37 \times 37 \times 37 \times 4 = 202612$ divisor.
$376 \times 376 \times 376 \times 376 = 19987173376.$
Ans. 376, the biquadrate root required.

SIMPLE INTEREST.

THEOREM 1. $p\,r\,t. = I.$

(1) Here $p = £945,5$. $r = ,05$. $t = 3$, then $£945,5 \times ,05 \times 3 = 47,275 \times 3 = £141,825 = 141l.\ 16s.\ 6d.$ *Ans.*

(2) Here $p = £547,7$. $r = ,04$. $t = 6$, then $547,7 \times ,04 \times 6 = 21,908 \times 6 = £131,448 = 131l.\ 8s.\ 11\frac{1}{2}d.\ ,08$, *Ans.*

(3) Here $p = £796,75$. $r = ,045$. $t = 5$, then $796,75 \times ,045 \times 5 = £35,85375 \times 5 = £179,26875 = 179l.\ 5s.\ 4\frac{1}{2}d.$ *Ans.*

(4) Here $p = £397,47083$. $r = ,035$. $t = 3,5$, then $397,47083 \times ,035 \times 3,5 = £34,7786979 = 34s.\ 15s.\ 6\frac{3}{4}d.\ ,55$, *Ans.*

(5) Here $p = £554,875$. $r = ,045$. $t = 3\frac{3}{5} = 3,6$, then $554,875 \times ,045 \times 3,6 = £91,554375 = 91l.\ 11s.\ 1d. - ,2$, *Ans.*

(6) Here $p = £236,93$. $r = ,055$. $t = 3\frac{3}{5} = 3,6$, then $236,93 \times ,055 \times 3,6 = £47,781555416 = 47l.\ 15s.\ 7\frac{1}{2}d,293 +$ *Ans.*

How to find the Interest for any Number of Days.

(7) First the decimal, or interest of one pound for a day at 4 *per ct.*is,04÷365=,00010958904,then ,00010958904 × £240× 120=£3,156164352=3*l.* 3*s.* $1\frac{1}{4}$*d.* ,9+*Ans.*

(8) ,0001369863 × £364,9 × 154 = £7,69789 + = 7*l.* 13*s.* $11\frac{1}{4}$*d.* ,9+*Ans.*

(9) ,00010958904×£725,75×74 = £5,88553418= 5*l.* 17*s.* $8\frac{1}{2}$*d.* ,1128+*Ans.*

(10) The number of days from the 1st of June, 1775, to the 9th of March, 1776, is 281 days, then ,0001369863 ×100×281=£3,84931503=3*l.* 16*s.* $11\frac{3}{4}$*d.* ,342+*Ans.*

THEOREM 2. $ptr+p=A$.

(11) Here p=£279,6. t=7. r=,045. then $\overline{279,6\times 6\times ,045}$+£279,6=£367,674=376*l.* 13*s.* $5\frac{3}{4}$*d.* ,04, *Ans.*

(12) $\overline{£320,85\times ,035\times 5}$ +£320,85 = £56,14875+ £320,85+£376,99875=376*l.* 19*s.* $11\frac{1}{2}$*d.* ,8, *Ans.*

(13) £926,6×,04×5,5=£203,852, then £203,852 +£926,6=1130,452=1130*l.* 9*s.* $0\frac{1}{4}$*d.* ,92. *Ans.*

(14) £273,9×,03×4,479452=£36,807657084, then 36,807657084 + 273,9 = £310,707657084 = 310*l.* 14*s.* $1\frac{3}{4}$*d*, ,35+*Ans.*

THEOREM 3. $\dfrac{a}{tr+1}=P$.

(15) Here a=367,674. t=7. r=,045, then 3 $\dfrac{367,674}{7\times ,045+1}$ =£279,6=+279*l.* 12*s.* 0*d.* *Ans.*

(16) $\dfrac{376,99875}{5\times ,035+1}$=£320,85=320*l.* 17*s.* 0*d.* *Ans.*

(17) $\dfrac{1130,452}{5,5\times ,04+1}$=£926,6=926*l.* 12*s.* 0*d.* *Ans.*

(18) $\dfrac{310,707657084}{,03\times 4,479452}$=£273,9=273*l.* 18*s.* 0*d.* *Ans.*

THEOREM 4. $\frac{a-p}{pt}=R.$

(19) Here $a=367,674$. $p=279,6$. $t=7$. $\frac{367,674-279,6}{279,6\times 7}$ $=\frac{88,074}{1957,2}=,045$, or $4\frac{1}{2}$ rate per cent. *Ans.*

(20) Here $\frac{376,99875-320,85}{320,85\times 5}=\frac{56,14875}{1604,25}=,035$. or $3\frac{1}{2}$ per cent. *Ans.*

(21) Here $\frac{1130,452-926,6}{926,6\times 5,5}=\frac{203,852}{5096,3}=,04$, or 4 per cent. *Ans.*

(22) Here $\frac{310,707657084-273,9}{273,9\times 4,479452}=\frac{36,807657084}{1226,9219028}=$,03, or 3 per cent. *Ans.*

THEOREM 5. $\frac{a-p}{pr}=T.$

(23) Here $\frac{367.674-279.6}{279,6\times ,045}=\frac{88,074}{12,582}=7$ years, *Ans.*

(24) Here $\frac{376,99875-320,85}{320,85\times ,035}=\frac{56,14875}{11,22975}=5$ yrs. *Ans.*

(25) Here $\frac{1130,452-926,6}{926,6\times ,04}=\frac{203,852}{37,064}=5,5$, or $5\frac{1}{2}$ yrs. *Ans.*

(26) Here $\frac{310,707657084-273,9}{273,9\times ,03}=\frac{36,807657084}{8,217}=$ $4,479452+=4$ yrs. 175 days, *Ans.*

ANNUITIES OR PENSIONS, &c. IN ARREARS.

THEOREM 1. $\frac{ttu-tu}{2}\times r+tu=A.$

(27) Here $u=£150$. $t=5$. $r=,05$. then $\frac{\overline{5\times 5\times 150}-\overline{5\times 150}}{2}=\overline{1500}\times ,05+\overline{5\times 150}=£825$, the amount required, *Ans.*

(28) Here $\frac{\overline{7\times7\times250}-\overline{7\times250}}{2}=5250$, then $\overline{5250\times06}+\overline{250\times7}=\pounds2065$, *Ans.*

(29) Here $\frac{\overline{5,5\times5,5\times60}-\overline{5,5\times60}}{2}=\pounds742,5$, then $\overline{\pounds742,5\times,045}+\overline{5,5\times60}=\pounds363,4125=363l.\ 8s.\ 3d.$ *Ans.*

(30) Here $\frac{\overline{8\times8\times28}-\overline{8\times28}}{2}=784$, then $\pounds784\times,05+\overline{8\times28}=\pounds263,2=263l.\ 4s.\ 0d$ *Ans.*

When the Annuities, &c. are to be paid half-yearly, or quarterly.

(31) Here $\frac{\overline{10\times10\times75}-\overline{10\times75}}{2}=3375$. $\overline{\pounds3375\times,025}+\overline{75\times10}=\pounds834,375=834l.\ 7s.\ 6d.=$ amount for half-yearly payments, *Ans.*

(32) Here $\frac{20\times20\times37,5-20\times37,5}{2}=7125$.
$\overline{7125\times,0125}+\overline{20\times37,5}=\pounds839,0625=839l.\ 1s.\ 3d.=$ the amount at quarterly payments, *Ans.*

THEOREM 2. $\frac{2a}{ttr-tr+2t}=U.$

(33) Here $a=\pounds825$. $t=5$. $r=,05$, then
$\frac{825\times2}{5\times5\times,05-5\times,05+2\times5}=\frac{1650}{1,25-,25+10}=\frac{1650}{11}=$ £150 the salary, *Ans.*

(34) Here $\frac{\pounds363,4125\times2}{5,5\times5,5\times,045-5,5\times,045+2\times5,5}=$
$\frac{726,825}{12,11375}=$ £60 yearly rent, *Ans.*

(35) Here $\frac{2065\times2}{7\times7\times,06-7\times,06+2\times7}=\frac{4130}{1652}=\pounds250$ the pension, *Ans.*

(36) Here $\frac{263,2\times 2}{8\times 8\times ,05-8\times ,05+2\times 8}=\frac{526,4}{18,8}=$ £28 the pension, *Ans.*

Of half-yearly Payments, &c.

(37) Here $\frac{834,375\times 4}{10\times 10\times ,025-10\times ,025+2\times 10}=\frac{3337,50}{22,25}$ =£150=half-yearly salary, *Ans.*

(38) Here $\frac{839,0625\times 8}{20\times 20\times ,0125-20\times ,0125+2\times 20}=\frac{6712,5}{44,75}$ =£150=quarterly salary, *Ans.*

THEOREM 3. $\frac{2a-2ut}{utt-ut}=R.$

(39) Here $a=$ £825. $u=$ £150. $t=5$, then $\frac{825\times 2-2\times 150\times 5}{150\times 5\times 5-150\times 5}=\frac{150}{3000}=,05$, or £5 per cent. *Ans.*

(40) Here $\frac{363,4125\times 2-60\times 2\times 5,5}{5,5\times 5,5\times 60-60\times 5,5}=\frac{726,825-660}{1485}=$ $\frac{66,825}{1485}=,045$, or £$4\frac{1}{2}$ per cent. *Ans.*

(41) Here $\frac{2065\times 2-2\times 250\times 7}{250\times 7\times 7-250\times 7}=\frac{630}{10500}=,06$, or £6 rate per cent. *Ans.*

(42) Here $\frac{263,2\times 2-2\times 28\times 8}{28\times 8\times 8-28\times 8}=\frac{78,4}{1568}=,05$, or £5 rate per cent. *Ans.*

When the Payments are half-yearly, &c.

(43) Here $\frac{834,375\times 4-150\times 5\times 4}{75\times 10\times 10-10\times 75}=\frac{337,5}{6750}=,05$, or £5 rate per cent. *Ans.*

(44) Here $\frac{839,0625\times 8-150\times 8\times 5}{37,5\times 20\times 20-37,5\times 20}=\frac{712,5}{14250}=,05$, or £5 rate per cent. *Ans.*

THEOREM 4. First, $x = \frac{2}{r} - 1.\ \sqrt{\frac{2a}{ru} + \frac{xx}{4}} - \frac{x}{2} = T.$

(45) Here $a = £825$. $u = £150$. $r = ,05$, then $\frac{2}{,05} - 1 = 39$, and $\sqrt{\frac{2 \times 825}{150 \times ,05} + \frac{39 \times 39}{4}} - \frac{39}{2} = \sqrt{600,25} - 19,5 =$ $24,5 - 19,5 = 5$ years, *Ans.*

(46) Here $\frac{2}{,045} - 1 = 43,4.\ \sqrt{\frac{363,4125 \times 2}{60 \times 045} + \frac{43,4 \times 43,4}{4}} - \frac{43,4}{2} = 5\frac{1}{2}$ years, *Ans.*

(47) Here $\frac{2}{,06} - 1 = 32,3.\ \sqrt{\frac{2065 \times 2}{250 \times ,06} + \frac{32,3 \times 32,3}{4}} - \frac{32,3}{2} = 7$ years, *Ans.*

(48) Here $\frac{2}{,05} - 1 = 39.\ \sqrt{\frac{263,2 \times 2}{23 \times ,05} + \frac{39 \times 39}{4}} - \frac{39}{2} = 8$ years, *Ans.*

When the Payments are half-yearly, &c.

(49) First $\frac{2}{,025} - 1 = 79.\ \sqrt{\frac{834,375 \times 2}{75 \times ,025} + \frac{79 \times 79}{4}} - \frac{79}{2} =$ $49,5 - 39,5 = 10$, the number of payments, hence 5 years is the *Ans.*

(50) First $\frac{2}{,0125} - 1 = 159.\ \sqrt{\frac{839,0625 \times 2}{37,5 \times ,0125} + \frac{159 \times 159}{4}} - \frac{159}{2} = 20$, the number of payments, hence 5 years the *Ans.*

PRESENT WORTH OF ANNUITIES.

THEOREM 1. $\frac{ttr-tr+2t}{2tr+2}\times u=\text{P}.$

(51) Here $u=$£150. $t=5$. $r=,05$, then

$\frac{\overline{5\times5\times,05}-\overline{5\times,05}+\overline{2\times5}}{\overline{2\times5\times,05}+2}\times150=\frac{11}{2,5}=4,4$ and $4,4\times150=$£660, *Ans.*

(52) Here $\frac{\overline{5,5\times5,5\times,045}-\overline{5,5\times,045}+\overline{2\times5,5}}{\overline{2\times5,5\times,045}+2}\times60=$ £291,3125=291*l.* 6*s.* 3*d.* *Ans.*

(53) Here $\frac{\overline{7\times7\times,06}-\overline{7\times,06}+\overline{2\times7}}{\overline{2\times7\times,06}+2}=\frac{16,52}{2,84}\times$ £250 $=1454$*l.* 4*s.* 6*d.*

(54) Here $\frac{\overline{8\times8\times,05}-\overline{8\times,05}+\overline{2\times8}}{\overline{2\times8\times,05}+2}\times28=\frac{18,8}{2,8}\times28$ =£188, *Ans.*

How to find the present Worth of any Sum of Money payable half-yearly, &c.

(55) Here $\frac{\overline{20\times20\times,0125}-\overline{20\times,0125}+\overline{2\times20}}{\overline{2\times20\times,0125}+2}\times37,5$ =£671, 25=671*l.* 5*s.* 0*d.* the present worth, *Ans.*

THEOREM 2. $\frac{tr+1}{ttr-tr+2t}\times2p=\text{U}.$

(56) Here $p=660$. $t=5$. $r=,05$, then

$\frac{\overline{5\times,05}+1}{\overline{,05\times5\times5}-\overline{5\times,05}+2t}\times660\times2=\frac{1,25}{11}\times1320=$ £150 the salary, *Ans.*

(57) Here $\frac{\overline{5,5\times,045+1}}{5,5\times 5,5\times,045-5,5\times,045+5,5\times 2}\times$ $291,3125\times 2=\frac{1,2475}{12,11375}\times 582,625=$ £60 the required rent, *Ans.*

(58) Here $\frac{\overline{7\times,06+1}}{7\times 7\times,06-7\times,06+2\times 7}\times$ £$1454,225\times 2$ $=\frac{1,42}{16,52}\times 2908,45=$ £250 required annuity, *Ans.*

(59) Here $\frac{\overline{8\times,05+1}}{8\times 8\times,05-8\times,05+2\times 8}\times$ £$188\times 2=$ $\frac{1,4}{18,8}\times 376=$ £28 the annuity required, *Ans.*

When the Payments are half-yearly, &c.

(60) Here $\frac{\overline{10\times,025+1}}{10\times 10\times,025-10\times,025+2\times 10}\times$ £$667,5$ $\times 4=\frac{1,25}{22,25}\times 2670=$ £150, *Ans.*

(61) Here $\frac{\overline{20\times,0125+1}}{20\times 20\times,0125-20\times,0125+2\times 20}\times$ £$671,25\times 8=\frac{1,25}{44,75}\times 5370=$ £150, *Ans.*

THEOREM 3. $\frac{\overline{tu-p}\times 2}{2pt+tu-ttu}=R.$

(62) Here $p=$ £660. $u=$ £150. $t=5$, then $\frac{\overline{5\times 150-660}\times 2}{2\times 660\times 5+5\times 150-5\times 5\times 150}=\frac{180}{3600}=\frac{1}{20}=,05$, or £5 the rate per cent. *Ans.*

(63) Here $\dfrac{\overline{5,5\times60-291,3125}\times2}{2\times5,5\times291,3125+5,5\times60-5,5\times5,5\times60}$ $=,045$, or the rate per cent. is $4\frac{1}{2}$, *Ans.*

(64) Here $\dfrac{\overline{7\times250-1454,225}\times2}{2\times1454,225\times7+7\times250-7\times7\times250}$ $,06$, or £6 rate per cent. *Ans.*

(65) Here $\dfrac{\overline{8\times28-188}\times2}{2\times188\times8+8\times28-8\times8\times28}=\dfrac{72}{1440}=\dfrac{3}{60}=$ $=,05$, or £5 rate per cent. *Ans.*

When the Annuities are to be paid half-yearly, &c.

(66) Here $\dfrac{\overline{10\times75-667,5}\times2}{2\times667,5\times10+10\times75-10\times10\times75}=\dfrac{165}{6600}$ $=\dfrac{15}{600}=\dfrac{1}{40}=,025$, or the rate per cent. is £5, *Ans.*

(67) Here $\dfrac{\overline{20\times37,5-671,25}\times2}{2\times671,25\times20+20\times37,5-20\times20\times37,5}$ $=\dfrac{157,5}{12600}=,0125$, or £5 the rate per cent. *Ans.*

THEOREM 4. $\sqrt{\dfrac{2p}{ru}+\dfrac{xx}{4}}-\dfrac{x}{2}=T.$ when $x=\dfrac{2}{r}-\dfrac{2p}{u}-1.$

(68) Here $p=$ £660. $u=150$. $r=,05$, then $\dfrac{2}{,05}-\dfrac{1320}{150}$ $-1=30,2$ $\sqrt{\dfrac{660\times2}{150\times,05}+\dfrac{30,2\times30,2}{4}}-\dfrac{30}{2}=\sqrt{404,01}-\dfrac{30}{2}$ $=5,1$ years, or 5 years the time of continuance, *Ans.*

(69) First $\dfrac{2}{,045}-\dfrac{582,625}{60}-1=44,4$

$\sqrt{\dfrac{291,3125\times2}{60\times,045}+\dfrac{33,734027\times33,734027}{4}}-\dfrac{33,734027}{2}=$ $\sqrt{500,282687}-16,867=22,367-16,867=5,5=5\frac{1}{2}$ years, *Ans.*

(70) First $\frac{2}{,06} - \frac{1454,225 \times 2}{250} - 1 = 20,6995$

$\sqrt{\frac{1454,225 \times 2}{250 \times ,06} + \frac{20,6995 \times 20,6995}{4}} - \frac{20,6995}{2} =$

$\sqrt{300,98191} = 17,349 - 10,349 = 7$ years, *Ans.*

(71) First $\frac{2}{,05} - \frac{2 \times 188}{28} - 1 = 25,5715$

$\sqrt{\frac{188 \times 2}{28 \times ,05} + \frac{25,5715 \times 25,5715}{4}} - \frac{25,5715}{2} =$

$\sqrt{432,0464287} - 12,7857 = 20,7857 - 12,7857 = 8$ years, *Ans.*

When the Payments are half-yearly, &c.

(72) First $\frac{2}{,025} - \frac{667,5 \times 2}{75} - 1 = 61,2$

$\sqrt{\frac{667,5 \times 2}{75 \times ,025} + \frac{61,2 \times 61,2}{4}} - \frac{61,2}{2} = \sqrt{1648,36} - 30,6 =$

$40,6 - 30,6 = 10$, the number of payments, then 5 years is the time, *Ans.*

(73) First $\frac{2}{,0125} - \frac{671,25 \times 2}{37,5} - 1 = 123,252$

$\sqrt{\frac{671,25}{37,5 \times ,0125} + \frac{123,252 \times 123,252}{4}} - \frac{123,252}{2} = 20$, the number of payments, or 5 years, *Ans.*

ANNUITIES, &c. TAKEN IN REVERSION.

1. *To find the present worth of an Annuity taken in reversion.*

THEOREM 1. $\frac{ttr - tr + 2t}{2tr + 2} \times u = P.$ and when P. is changed into A. then THEOREM 2. $= \frac{a}{tr + 1} = P.$

(74) First $\frac{\overline{5 \times 5 \times ,05} - \overline{5 \times ,05} + 2 \times 5}{2 \times 5 \times ,05 + 2} \times 150 = 4,4 \times 150$

$= £660$, then $\frac{660}{4 \times ,05 + 1} = \frac{660}{1,2} = £550$, *Ans.*

(75) First $\frac{\overline{4\times4\times,04}-\overline{4\times,04}+\overline{2\times4}}{\overline{2\times4\times,04}+2}\times 50=\frac{8,48}{2,32}\times 50$

$=3,6551724\times 50=182,75862$, then $\frac{182,75862}{\overline{5\times,04}+1}=$

$\frac{182,75862}{1,2}=152l.\ 5s.\ 11\frac{3}{4}d.$ *Ans.*

(76) First $\frac{\overline{8\times8\times,05}-\overline{8\times,05}+\overline{2\times8}}{\overline{2\times8\times,05}+2}\times 20=\frac{18,8}{2,8}\times 20$

$\overset{\pounds.}{=}134\frac{2}{7}$, then $\frac{134\frac{2}{7}}{\overline{4\times,05}+1}=\frac{134,2857142}{1,2}=\pounds 111,9047618$

$=111l.\ 18s.\ 1\frac{1}{4}d.\ ,7+$ *Ans.*

(77) First $\frac{\overline{6\times6\times,04}-\overline{6\times,04}+\overline{2\times6}}{\overline{2\times6\times,04}+2}\times 40=\frac{528}{2,48}=\frac{66}{,31}$

$=202,903225$, then $\frac{202,903225}{\overline{6\times,04}+1}=\frac{202,903225}{1,24}=$

$\pounds 171,69614919=171l.\ 13s.\ 11d.\ ,0758$, *Ans.*

To find the yearly Income of an Annuity, &c. in reversion.

THEOREM 1. $ptr+p=A$ and when A is changed into P.

then THEOREM 2. $\frac{tr+1}{ttr-tr+2t}\times 2p=U.$

(78) First $550\times4\times,05+550=\pounds 660$, then

$\frac{\overline{5\times,05}+1}{\overline{5\times5\times,05}-\overline{5\times,05}+\overline{2\times5}}\times 2\times 660=\frac{1650}{11}=\pounds 150$, *Ans.*

(79) First $\overline{152,3\times5\times,04}+152,3=\pounds 182,76$, then

$\frac{\overline{4\times,04}+1}{\overline{4\times4\times,04}-\overline{4\times,04}+\overline{2\times4}}\times 2\times 182,76=\frac{424,0032}{8,48}=50l.$

yearly rent, *Ans.*

(80) First $\pounds\overline{111,90475\times4\times,05}+111,90475=$

$\pounds 134,2857$, then $\frac{\overline{8\times,05}+1}{\overline{8\times8\times,05}\times\overline{8\times,05}+\overline{2\times8}}\times 2\times$

$134,2857\,\frac{376}{18,8}=\pounds 20$ the rent, *Ans.*

(81) First $\overline{171,7\times 6\times ,04}+\pounds 171,7=\pounds 212,908$, then

$$\frac{\overline{6\times ,04+1}}{\overline{6\times 6\times ,04}-\overline{6\times ,04+2\times 6}}\times 2\times 212,908=\frac{528,01184}{13,2}=$$

£40 annuity left him, *Ans.*

REBATE OR DISCOUNT.

THEOREM 1. $\frac{s}{tr+1}=P.$

(1) First $s=\pounds 357,5.\ t=,75.\ r=,05$, then $\frac{357,5}{\overline{,75\times ,05+1}}$ $=\frac{357,5}{1,0375}=\pounds 344,5783=344l.\ 11s.\ 6\frac{3}{4}d.\ ,168$, *Ans.*

(2) First $\frac{275,5}{\overline{,583\times ,05+1}}=\frac{66120}{247}=\pounds 267,6923=\pounds 267.$ 13*s*. 10*d*. ,152, *Ans.*

(3) First $\frac{875,275}{\overline{,416\times ,045+1}}=\frac{140044}{163}=\pounds 859,16569=$ 859*l*. 3*s*. $3\frac{3}{4}d.$,0624, *Ans.*

(4) First $\frac{75}{\overline{1,25\times ,05+1}}=\frac{75}{1,0625}=\pounds 70,588235=70l,$ 11*s*. 9*d*. ,1764+*Ans.*

THEOREM 2. $ptr+p=S.$

(5) First $\overline{\pounds 344,5783\times ,75\times ,05}+344,5783=\pounds 357,5$ $=357l.\ 10s.\ 0d.$ *Ans.*

(6) First $267,69235\times ,583\times ,05+267,69235=\pounds 275,5$ $=275l.\ 10s.\ 0d.$ *Ans.*

N.B. $s-rst+r^2st^2-$&c.$=P.$

(7) First £859,16589 × ,416 × ,045 + 859,16589 = £875,27525 = 875*l.* 5*s.* 6*d.* ,06 + *Ans.*

(8) First 70,588235 × 1,25 × ,05 + 70,588235 = £75, *Ans.*

THEOREM 3. $\frac{s-p}{tp}=R.$

(9) First $\frac{£357,5-£344,5783}{344,5783\times,75}=\frac{12,9217}{258,433725}=,05$, or £5 the rate per cent. *Ans.*

(10) First $\frac{£275,5-£267,6923}{267,6923\times,583}=\frac{7,8077}{156,1538}=,05$, or £5 the rate per cent. *Ans.*

(11) First $\frac{£875,275-£859,16589}{859,16589\times,416}=\frac{16,10911}{357,9858}=,045$, or £4½ the rate per cent. *Ans.*

(12) First $\frac{£75-£70,588235}{70,588235\times1,25}=\frac{4,411765}{88,2353}=,05$, or £5 the rate per cent. *Ans.*

THEOREM 4. $\frac{s-p}{rp}=T.$

(13) First $\frac{£357,5-£3444,5783}{344,5783\times,05}=\frac{12,9217}{17,228915}=,75$, or 9 months, *Ans.*

(14) First $\frac{£275,5-£267,69235}{267,69235\times,05}=\frac{7,80765}{13,3846175}=,583$, or 7 months, *Ans.*

(15) First $\frac{£875,275-£859,16589}{859,16589\times,045}=\frac{16,10911}{38,662464}=,416$, or 5 months, *Ans.*

(16) First $\frac{£75-£70,588235}{70,588235\times,05}=\frac{4,411765}{3,52941175}=,1,25$, or 15 months, *Ans.*

EQUATION OF PAYMENTS.

THEOREM 1. $\frac{s}{tr+1}=P$. Add all the present worths together, then $s-p=D$, and THEOREM 2. $\frac{d}{pr}=E$.

(1) First $\frac{40}{1,0125}=39,5061$. $\frac{60}{1,025}=58,5365$. $\frac{100}{1,0375}=96,3855$. £$200-\overline{39,5061+58,5365+96,3855}=200-194,4281=5,5719$, then $\frac{5,5719}{194,4281\times,05}=,57315=$ 6 months and 26,334 days, *Ans.*

(2) First $\frac{200}{1,0125}=197,5308$. $\frac{200}{1,016}=196,7249$. $\frac{400}{1,025}=390,2439$, then £$800-\overline{197,5308+196,7249+390,2439}=800-784,4996=15,5004$. $\frac{15,5004}{784,4996}=,395=$ 4 months 22,2 days, *Ans.*

(3)

	£.		£.
$\frac{500}{,86\times,03+1}$	$=487,804$		
$\frac{500}{1,6\times,03+1}$	$=476,193$		1200
	200 pd. down		1163,997
Sum	1163,997		36,003

then $\frac{36003}{1163,997\times,03}=1,031$ =1 year, 11,3 days, *Ans.*

COMPOUND INTEREST.

THEOREM 1. $p\times rt=A$.

(1) First $p=$£225. $t=3$. $r=1,05$, then $\overline{1,05}|^{3}=1,157625$, and $1,157625\times225=$£$260,465625=$£260. 9*s*. $3\frac{3}{4}$*d*. *Ans.*

(2) First $p=£200$. $t=4$. $r=1,05$, then $\overline{1,05}|^{4}=$ 1,21550625, then $1,21550625 \times 200 = £243,10125 =$ 243*l.* 2*s.* 0*d.* ,025, *Ans.*

(3) First $p=£450$. $t=5$. $r=1,04$, then $\overline{1,04}|^{5}=$ 1,2166529, and $1,2166529 \times 450 = £547,493805 = £547$. 9*s* $10\frac{1}{2}$*d.* ,05, *Ans.*

(4) First $p=£500$. $t=4$. $r=1,055$, then $\overline{1,055}|^{4}=$ 1,23882465, then $1,23882465 \times 500 = £619,412325 =$ 619*l.* 8*s.* $2\frac{3}{4}$*d.* ,832, *Ans.*

THEOREM 2. $\frac{a}{rt}=P$.

(5) Here $a=260,465625$. $t=3$. $r=1,05$, then $\frac{260,465625}{\overline{1,05}|^{3}}$ $=\frac{260,465625}{1,157625}=£225$ principal, *Ans.*

(6) Here $\frac{243,10125}{\overline{1,05}|^{4}}=\frac{243,10125}{2,1550625}=£200$ principal, *Ans.*

(7) Here $\frac{547,493805}{\overline{1,04}|^{5}}=\frac{547,493805}{1,2166529}=£450$ principal,

(8) Here $\frac{619,412325}{\overline{1,055}|^{4}}=\frac{619,412325}{1,23882465}=£500$ principal, *Ans.*

THEOREM 3. $\frac{a}{p}=rt$.

(9) Here $a=260,465625$. $p=225$. $t=3$. $\frac{260,465625}{225}$ $=1,157625$, the cube root of which is 1,05, then $£5=$ rate per cent, *Ans.*

(10) Here $\frac{243,10125}{200}=1,21550625$, the biquadrate root of which is 1,05, or £5 per cent. *Ans.*

(11) Here $\frac{547,493805}{450}=1,2166529$, the sursolid root of which is 1,04, or £4 per cent. *Ans.*

(12) Here $\frac{619,412325}{500}=1,23882465$, the biquadrate of which is 1,055, or £5½ per cent, *Ans.*

THEOREM 4. $\frac{a}{p}=rt.$

(13) Here $\frac{260,465625}{225}=1,157625$. $\frac{1,157625}{1,05}=1,1025$. $\frac{1,025}{1,05}=1,05$. $\frac{1,05}{1,05}=1$, here the number of divisions being 3, is the required time, *Ans.*

(14) Here $\frac{243,10125}{200}=1,21550625$. $\frac{1,21550625}{1,05}=$ 1,157625. $\frac{1,157625}{1,05}=1,1025$. $\frac{1,1025}{1,05}=1,05$. $\frac{1,05}{1,05}=1$. here the number of divisions are 4, the time required, *Ans.*

(15) Here $\frac{547,493805}{450}=1,2166529$. $\frac{1,2166529}{1,04}=$ 1,1698586. $\frac{1,1698586}{1,04}=1,124864$. $\frac{1,124864}{1,04}=1,0816$. $\frac{1,0816}{1,04}=1,04$. $\frac{1,04}{1,04}=1$, here the number of divisions are 5, the time required, *Ans.*

(16) Here $\frac{619,412325}{500}=1,23882465$. $\frac{1,23882465}{1,055}=$ 1,174241375, $\frac{1,174241375}{1,055}=1,113025$. $\frac{1,113025}{1,055}=$ 1,055. $\frac{1,055}{1,055}=1$; here the number of divisions are 4, the time required, *Ans.*

ANNUITIES OR PENSIONS IN ARREARS.

THEOREM 1. $\frac{ur^t - u}{r-1} = A.$

(17) Here $u=50$. $t=4$. $r=1,05$, then $\frac{\overline{\overline{1,05}^{4} \times 50 - 50}}{1,05-1}$ $= \frac{\overline{1,21550625 \times 50} - 50}{,05} = \frac{10,7753125}{,05} = £215,50625 =$ 215*l.* 10*s.* $1\frac{1}{2}$*d.* the amount, *Ans.*

(18) Here $\frac{\overline{\overline{1,05}^{5} \times 45} - 45}{1,05-1} = \frac{12,432672}{,05} = £248,65345$ $= 248$*l.* 13*s.* $0\frac{3}{4}$*d.* ,3, *Ans.*

(19) Here $\frac{\overline{\overline{1,06}^{6} \times 40} - 40}{1,06-1} = \frac{16,740764}{,06} = 279$*l.* 0*s.* 3*d.* ,05, *Ans.*

(20) Here $\frac{\overline{\overline{1,06}^{10} \times 75} - 75}{1,06-1} = £988,559625 = £988.$ 11*s.* $2\frac{1}{4}$*d.* ,2, *Ans.*

THEOREM 2. $\frac{ar - a}{r^t - 1} = U.$

(21) Here $a=215,50625$. $t=4$. $r=1,05$, then $\frac{\overline{215,50625 \times 1,05} - 215,50625}{\overline{1,05}^{4} - 1} = \frac{10,7753125}{0,21550625} = £50$ annuity, *Ans.*

(22) Here $\frac{\overline{248,65345 \times 1,05} - 248,65345}{\overline{1,05}^{5} - 1} = \frac{12,4326725}{,2762816}$ $= £45$, *Ans.*

(23) Here $\frac{\overline{279,0128 \times 1,06} - 279,0128}{\overline{1,06}^{6}} = \frac{16,740768}{,4185191} =$ £40, *Ans.*

(24) Here $\frac{\overline{988,559625 \times 1,06} - 988,559625}{\overline{1,06}^{10} - 1} =$ $\frac{59,3135775}{,7908477} = £75$, *Ans.*

THEOREM 3. $\frac{\overline{ar+u}-a}{u}=r^t$.

(25) Here $a=215,50625$. $u=50$. $r=1,05$

$\frac{\overline{215,50625\times 1,05+50}-215,50625}{50}=\frac{60,7753125}{50}=$

1,21550625=4th power of 1,05, then 4 is the number of years, *Ans.*

Or thus, $\frac{1,21550625}{1,05}=1,157625$. $\frac{1,157625}{1,05}=1,1025$.

$\frac{1,1025}{1,05}=1,05$. $\frac{1,05}{1,05}=1$, the number of divisions=4, or 4 years, *Ans.*

(26) Here $\frac{\overline{248,65345\times 1,05+45}-248,65345}{45}=$

$\frac{57,432625}{45}=1,2762816$=5th power of 1,05, then 5 is the number of years, *Ans.* or divided by 1,05 continually, the number of divisions will be 5, or 5 years, *Ans.*

(27) Here $\frac{\overline{279,0128\times 1,06+40}-279,0128}{40}=\frac{56,740768}{40}$

=1,4185192=6th power of 1,06, therefore 6 is the number of years, *Ans.*

(28) Here $\frac{\overline{988,559625\times 1,06+75}-988,559625}{75}=$

$\frac{134,3135775}{75}=1,7908477$=10th power of 1,06, therefore 10 is the number of years, *Ans.*

PRESENT WORTH OF ANNUITIES, &c.

THEOREM 1. $\frac{u-\frac{u}{r^t}}{r-1}=P$.

(29) Here $u=30$. $t=7$. $r=1,06$, then $30-\frac{30}{\overline{1,06}|^7}=$

$30-\frac{30}{1,5036302}=30-19,9517=10,0483$, then $\frac{10,0483}{1,06-1}=$

$\frac{10,0483}{,06}=$ £167,4716=167*l.* 9*s.* 5*d.* ,184, *Ans.*

(30) First $40-\frac{40}{\overline{1,05}|^{8}}=12,926326$, then $\frac{12,926326}{1,05-1}=$

$\frac{12,926326}{,05}=$ £258,52652=258*l.* 10*s.* 6¼*d.* ,4, *Ans.*

(31) First £$35-\frac{35}{\overline{1,06}|^{7}}=11,723$, then $\frac{11,723}{1,06-1}=\frac{11,723}{,06}$

=£195,383=195*l.* 7*s.* 7¾*d.* ,9, or 195*l.* 7*s.* 8*d.* *Ans.*

(32) Here $50-\frac{50}{\overline{1,05}|^{5}}=10,82365$, then $\frac{10,82365}{1,05-1}=$

$\frac{10,82365}{,05}=$ £216,473=216*l.* 9*s.* 5½*d.* ,08, *Ans.*

THEOREM 2. $\frac{\overline{pr^{t}\times r}-pr_{t}}{r^{t}-1}=U.$

(33) Here $p=167,4716$. $t=7$. $r=1,06$, then

$\frac{\overline{167,4716\times\overline{1,06}|^{7}\times1,06}-167,4716\times\overline{106}|^{7}}{\overline{1,06}|^{7}-1}=\frac{15,10891}{0,50363}$

=£30 annuity, *Ans.*

(34) Here $\frac{\overline{258,52652\times\overline{1,05}|^{3}\times1,05}-258,52652\times\overline{1,05}|^{3}}{\overline{1,05}|^{8}-1}$

$=\frac{19,0981}{,477455}=$ £40 the salary, *Ans.*

(35) Here $\frac{\overline{195,383\times\overline{1,06}|^{7}\times1,06}-195,383\times\overline{1,06}|^{7}}{\overline{1,06}|^{7}-1}=$

$\frac{17,62705}{,5063}=$ £35 annuity, or pension, *Ans.*

(36) Here $\frac{\overline{216,473\times\overline{1,05}|^{5}\times1,05}-216,473\times\overline{1,05}|^{5}}{\overline{1,05}|^{5}}=$

13,814÷,2762=£50 annuity, *Ans.*

THEOREM 3. $\frac{u}{p+u-pr}=r^t$.

(37) Here $p=167{,}4716$. $u=30$. $r=1{,}06$, then

$$\frac{30}{167{,}4716+30-167{,}4716\times1{,}06}=\frac{30}{19{,}951704}=1{,}50363$$

$=$7th power of 1,06, or 7 years, *Ans.* Or if 1,50363 is continually divided by $r=1{,}06$, the number of those divisions will be the time, *viz.* 7 years as required.

(38) Here $\frac{40}{258{,}52652+40-258{,}52652\times1{,}05}=$

$\frac{40}{27{,}07367}=1{,}477455=$8th power of 1,05, *viz.* 8 years is the *Ans.* if it is divided by r, the number of divisions will be 8=years required.

(39) Here $\frac{35}{195{,}383+35-195{,}383\times1{,}06}=\frac{35}{23{,}276}=$ 1,50363=7th power of 1,06, or 7 years for the *Ans.*

(40) Here $\frac{50}{216{,}473+50-216{,}473\times1{,}05}=\frac{50}{39{,}17635}=$ 1,27628=5th power of 1,05, or 5 years, *Ans.*

ANNUITIES, LEASES, &c. TAKEN IN REVERSION.

1. *To find the present Worth of Annuities, &c. taken in reversion.*

THEOREM 1. $u-\frac{u}{r^t}=$P, when P is changed into A, then

THEOREM 2. $\frac{a}{r^t}=$P, the present worth.

(41) First $40-\frac{40}{1{,}06}=11{,}8016$, then $\frac{11{,}8016}{1{,}06-1}$ £196,693,

$\frac{196{,}693}{\overline{1{,}06}|^2}=$£175,0563=175*l.* 1*s.* 1½*d.* ,048 present worth, *Ans.*

(42) First $60-\frac{60}{\overline{1,05}|^{7}}=17,3592$, then $\frac{17,3592}{1,05-1}=$ £$347,184$. and $\frac{347,184}{\overline{1,05}|^{3}}=$ £$299,9106=299l.\ 18s.\ 2\frac{1}{2}d.$ *Ans.*

(43) First $30-\frac{30}{\overline{1,05}|^{7}}=8,6796$, then $\frac{8,6796}{1,05-1}=$ £$173,592$, and $\frac{173,592}{\overline{1,05}|^{4}}=$ £$142,8145=142l.\ 16s.\ 3\frac{1}{2}d.$ *Ans.*

2. *To find the yearly Income of an Annuity, &c. taken in reversion.*

THEOREM 1. $pr^{t}=A$, and when A is changed into P, then

THEOREM 2. $\frac{pr^{t}\times r-pr^{t}}{r^{t}-1}=U.$

(44) First $175,0563\times\overline{1,06}|^{2}=196,6933$, then

$$\frac{196,6933\times\overline{1,05}|^{6}\times1,06-196,6933\times\overline{1,06}|^{6}}{\overline{1,06}|^{6}-1}=\frac{16,740786}{,4185191}$$

= £40 the annuity, *Ans.*

(45) First $299,9106\times\overline{1,05}|^{3}=347,184$, then

$$\frac{347,184\times\overline{1,05}|^{7}\times1,05-347.184\times\overline{1,05}|^{7}}{\overline{1,05}|^{7}-1}=\frac{24,42615}{,4071}=$$

£60 the annuity, *Ans.*

(46) First $142,8145\times\overline{1,05}|^{4}=173,592$, then

$$\frac{173,592\times\overline{1,05}|^{7}\times1,05-173.592\times\overline{1,05}|^{7}}{\overline{1,05}|^{7}-1}=\frac{12,21305}{,4071}=$$

£30 yearly rent, *Ans.*

PURCHASING FREEHOLD OR REAL ESTATES, SUCH AS ARE BOUGHT TO CONTINUE FOR EVER.

THEOREM 1. $\frac{u}{r-1}=W.$

(47) Here $u=50$. $r=1,05$, then $\frac{50}{1,05-1}=\frac{50}{,05}=$ £1000, *Ans.*

(48) Here $\frac{140}{1,04-1}=\frac{140}{,04}=$ £3500, the worth in present money, *Ans.*

(49) Here $\frac{75}{1,06-1}=\frac{75}{,06}=$ £1250 worth in present money, *Ans.*

THEOREM 2. $w\times\overline{r-1}=U.$

(50) Here $1000\times\overline{1,05-1}=1000\times,05=$ £50 yearly rent, *Ans.*

(51) Here $3500\times\overline{1,04-1}=3500\times,04=$ £140 rent required, *Ans.*

(52) Here $1250\times\overline{1,06-1}=1250\times,06=$ £75 yearly rent, *Ans.*

THEOREM 3. $\frac{w+u}{w}=R.$

(53) Here $w=1000$. $u=50$, then $\frac{1000+50}{1000}=\frac{105}{100}$ $=1,05=$ £5 the rate per cent. *Ans.*

(54) Here $\frac{3500+140}{3500}=\frac{3640}{3500}=\frac{364}{350}=1,04=$ £4 per cent. *Ans.*

(55) Here $\frac{1250+75}{1250}=\frac{1325}{1250}=1,06=$ £6 rate per cent, *Ans*

PURCHASING FREEHOLD ESTATES IN REVERSION.

To find the Worth of a Freehold Estate in reversion.

THEOREM 1. $\frac{u}{r-1}=W$, and when W is changed into A, then THEOREM 2. $\frac{a}{r^t}=P$.

(56) First $\frac{50}{1,05-1}=\frac{50}{,05}=1000$, then $\frac{1000}{\overline{1,05}|^4}=\frac{1000}{1,2155}$ $=£822,7067=822l.\ 14s.\ 1\frac{1}{2}d.$ *Ans.*

(57) First $\frac{200}{1,04-1}=5000$, then $\frac{5000}{\overline{1,04}|^2}=\frac{5000}{1,0816}=$ $£4622,781=4622l.\ 15s.\ 7\frac{1}{4}d.\ ,76$, *Ans.*

(58) First $\frac{240}{1,06-1}=\frac{240}{,06}=4000$, then $\frac{4000}{\overline{1,06}|^3}=\frac{4000}{1,191016}$ $=£3358,479=3358l.\ 9s.\ 6\frac{1}{2}d.$ *Ans.*

To find the yearly Rent of an Estate taken in reversion.

THEOREM 1. $wr^t=A$, and when A is changed into W, then THEOREM 2. $wr-w=U$.

(59) First $£822,7067\times\overline{1,05}|^4=1000$, then $\overline{1000\times 1,05}$ $-1000=£50$ the yearly income, *Ans.*

(60) First $£4622,781\times\overline{1,04}|^2=5000$, then $\overline{5000\times 1,04}$ $-5000=£200$, *Ans.*

(61) First $3358,479\times\overline{1,06}|^3=4000$, then $\overline{4000\times 1,06}-$ $4000=£240$, *Ans.*

REBATE OR DISCOUNT.

THEOREM 1. $\frac{s}{r^t}=P$.

(1) Here $s=315,6175$. $t=4$. $r=1,06$, then $\frac{315,6175}{\overline{1,06}|^4}=$ $\frac{315,6175}{1,26247}=£250$ the present worth, *Ans.*

(2) Here $\frac{344,7395}{\overline{1,05}|^7}=\frac{344,7395}{1,4071}=$£245 present worth, *Ans.*

(3) Here $\frac{441,8645}{\overline{1,06}|^4}=\frac{441,8645}{1,26247}=$£350 present worth, *Ans.*

THEOREM 2. $p\times r^t=S$.

(4) Here $p=250$. $t=4$. $r=1,06$, then $250\times1,26247=315l.\ 12s.\ 4d.\ ,2$, the sum due, *Ans.*

(5) Here $245\times1,4071=$ £$344,7395=344l.\ 14s.\ 9\frac{1}{4}d.\ ,92$, *Ans.*

(6) Here $350\times1,26247=$£$441,8645=441l.\ 17s.\ 3\frac{1}{4}d.\ ,92$, *Ans.*

THEOREM 3. $\frac{s}{p}=r^t$.

(7) Here $s=315,6175$. $p=250$. $\frac{315,6175}{250}=1,26247$ $=$4th power of 1,06, which being continually divided by 1,06, the number of divisions will be $4=$number of years, *Ans.*

(8) Here $\frac{344,7395}{245}=1,4071=$7th power of 1,05 the number of years, *Ans.*

(9) Here $\frac{441,8645}{350}=1,26247=$4th power of 1,06, then 4 years is the *Ans.*

THEOREM 4. $\frac{s}{p}=r^t$.

(10) Here $s=315,6175$. $p=250$, then $\frac{315,6175}{250}=$ 1,26247, then $\sqrt[4]{1,26247}=1,06$, or £6 the rate per cent. *Ans.*

(11) Here $\frac{344,7395}{245}=1,4071$, then $\sqrt[7]{1,4071}=1,05$, or £5 per cent. *Ans.*

(12) Here $\frac{441,8645}{350}=1,26247$, then $\sqrt[4]{1,26247}=1,06$ or £6 per cent, *Ans.*

PART IV.

DUODECIMALS:

OR, WHAT IS GENERALLY CALLED

Cross Multiplication, and squaring of Dimensions by Artificers and Workmen.

	Fe.	in.	p.
(1)	7	9	0
	3 ×	6	0
	23	3	0
	3	10	6
Ans.	27	1	6

	Fe.	in.	p.
(2)	8	5	0
	4 ×	7	0
	33	8	0
	4	10	11
Ans.	38	6	11

	Fe.	in.	p.
(3)	9	8	0
	7 ×	6	0
	67	8	0
	4	10	0
Ans.	72	6	0

	Fe.	in.	p.
(4)	8	1	0
	3 ×	5	0
	24	3	0
	3	4	5
Ans.	27	7	5

	Fe.	in.	p.
(5)	7	6	0
	5 ×	9	0
	37	6	0
	5	7	6
Ans.	43	1	6

	Fe.	in.	p.
(6)	4	7	0
	3 ×	10	0
	13	9	0
	3	9	10
Ans.	17	6	10

	Fe.	in.	p.	''	'''
(7)	7	5	9	0	0
	3	5	3	0	0
	22	5	3	0	0
	3	1	4	9	0
	0	1	10	5	3
Ans.	25	8	6	2	3

	Fe.	in.	p.	''	'''
(8)	10	4	5	0	0
	7	8	6	0	0
	72	6	11	0	0
	6	10	11	4	0
	0	5	2	2	6
Ans.	79	11	0	6	6

	Fe.	in.	p.
(9)	75	7	0
	9	8	0
	680	3	0
	50	4	8
Ans.	730	7	8

	Fe.	in.	p.
(10)	97	8	0
	8	9	0
	781	4	0
	73	3	0
Ans.	854	7	0

	Fe.	in.	p.
(11)	57	9	0
	9	5	0
	519	9	0
	24	0	9
Ans.	543	9	9

	Fe.	in.	p.
(12)	75	9	0
	17	7	0
	1287	9	0
	44	2	3
Ans.	1331	11	3

	Fe.	in.	p.
(13)	87	5	0
	35	8	0
	3059	7	0
	58	3	4
Ans.	3117	10	4

	Fe.	in.	p.
(14)	179	3	0
	38	10	0
	6811	6	0
	149	4	6
Ans.	6960	10	6

	Fe.	in.	p.
(15)	259	2	0
	48	11	0
	12440	0	0
	237	6	10
Ans.	12677	6	10

	Fe.	in.	p.
(16)	257	9	0
	39	11	0
	10052	3	0
	236	3	3
Ans.	10288	6	3

	Fe.	in.	p.	''	'''
(17)	311	4	7	0	0
	36	7	5	0	0
	11209	9	0	0	0
	181	7	8	1	0
	10	9	8	10	11
Ans.	11402	2	4	11	11

	Fe.	in.	p.	''	'''
(18)	321	7	3	0	0
	9	3	6	0	0
	2894	5	3	0	0
	80	4	9	9	0
	13	4	9	7	6
Ans.	2988	2	10	4	6

NOTE.—Any question in this rule may be proved by Practice, Vulgar Fractions, or Decimals, and also by reducing the factors into inches, and dividing by 144, the inches in a square foot,

1. By Practice.

	fe.	*in.*		*fe.*	*in.*
Example 3.	9	8	by	7	6
	7	6			
6*in.* is $\frac{1}{2}$)567		8			
	4	10			
	72	6 *Ans.*			

2. By Vulgar Fractions.

fe. in. fe.

$9\ 8 = 9\frac{2}{3} = \frac{29}{3}$

$\times$ by $7\ 6 = 7\frac{1}{2} = \frac{15}{2}$

then $\frac{29}{3} \times \frac{15}{2} = \frac{435}{6} = 72\frac{1}{2}$*fe.* $=72$*fe.* 6*in.* *Ans.* as above.

3. By Decimals.

fe. in. fe.

9 8=9, 6

7 6=7, 5

483

6766

72,49=72,49*fe.*=72*fe.* 6*in.* as before, *Ans.*

4. By reducing the Factors into Inches.

fe. in. in. *fe. in. in.*

9 8=116, and 7 6=90

then $\frac{116\times 90}{144} = \frac{2610}{36} = \frac{1305}{18} = \frac{145}{2} = 72\frac{1}{2}$*fe.*$=72$*fe.* 6*in.* same as before, *Ans.*

THE APPLICATION.

1. *Measuring by the Foot square, as Glaziers' and Masons' Flat-work.*

	fe.	in.		
(19) First	7	10		the heights added.
	6	8		
	5	4		
	19	10		
		3		
	59	6		in a tier.
	3	11		in breadth.
	178	6		
	54	6	6	
	233	0	6	whole superficies.

		fe.	in.	p.	
1*s.*	$\frac{1}{20}$	233	0	6	at 1*s.* 2*d.* per foot.
2*d.*	$\frac{1}{6}$	11	13	0	
		1	18	10	6*p.*$=\frac{1}{24}=$of $\frac{14}{24}d.=\frac{7}{12}$, or $\frac{1}{2}$.
		0	0	$0\frac{1}{2}$	
Ans.		13	11	$10\frac{1}{2}$	

	fe.	in.		
(20) First	4	10		
	2	11		
	9	8		
	4	5	2	
	14	1	2	content of one square.
			8	squares.
	112	9	4	=8 squares.

		fe.	in.	p.	
3d.	$\frac{1}{4}$	112	9	4	at $4\frac{1}{8}d.$ per foot.
1	$\frac{1}{3}$	28	0		
$\frac{1}{8}$	$\frac{1}{8}$	9	4		
		1	2		for 9 inches.
			3		for 9 inches.
		38	9		=1*l.* 18*s.* 9*d.* *Ans.*

(21)

	fe.	in.	
First	1	6	width.
		3	height.
	4	6	one window.
		8	
	36	0	=8 windows.

		fe.		
6*d.*	$\frac{1}{2}$	36		at $7\frac{1}{4}d.$
$1\frac{1}{2}$	$\frac{1}{4}$	18	0	
$\frac{1}{4}$	$\frac{1}{6}$	4	6	
		0	9	
		23	3	=1*l.* 3*s.* 3*d.* *Ans.*

(22)

	fe.	in.		
First	5	7		
	1	10		
	5	7	0	
	4	7	10	
	10	2	10	surface of the slab.

		fe.	in.	p.	
		10	2	10	at 6*s.*
Then 5*s.*	$\frac{1}{4}$	2	10	0	
1	$\frac{1}{5}$	0	10	0	
		0	1	0	for 2 inches.
		0	0	4	for 8 parts.
		0	0	1	for 2 parts.
		3	1	5	*Ans.*

2. *Measuring by the Yard square, as Paviors, Painters, Plasterers, and Joiners.*

	fe.	*in.*	*p.*	
(23) First	74	9	0	
	11	6	0	
	822	3	0	
	37	4	6	
	9)859	7	6	superficies of the room.
	95	4	7	6 ditto in yards, &c.

	s.	*d.*		*yds.*	*fe.*	*in.*	*p.*	
Then	2	6	$\frac{1}{8}$	95	4	7	6	at 3*s.* $10\frac{1}{2}$*d.* per yard.
	1	3	$\frac{1}{2}$	11	17	6		
	0	$1\frac{1}{2}$	$\frac{1}{10}$	5	18	9		
				0	11	$10\frac{1}{2}$		
				0	1	$3\frac{1}{2}$		for 3 feet.
				0	0	5		for 1 foot.
				0	0	3		for $7\frac{1}{2}$ inches.
				£18	10	1		*Ans.*

	fe.	*in.*		
(24) First	58	6		
	54	9		
	3159	0	0	
	43	10	6	
	3202	10	6	= area of the court-yard in feet, &c.

fe.	*in.*	*p.*	
9)3202	10	6	
355	7	10	6

		yds.	fe.	in.	p.
4*d.*	$\frac{1}{3}$	355	7	10	6
$\frac{1}{2}$	$\frac{1}{8}$	118	4		
$\frac{1}{4}$	$\frac{1}{2}$	14	$9\frac{1}{2}$		
		7	$4\frac{3}{4}$		
		0	$1\frac{1}{2}$		
		0	$1\frac{1}{2}$		
		0	$0\frac{1}{2}$		
		0	$0\frac{1}{4}$		
		140	10=7*l.* 0*s.* 10*d.* *Ans.*		

(25) *fe.* *in.*

First	97	8	0
	9	10	0
	879	0	0
	81	4	8
	9)960	4	8

2*s.*	$\frac{1}{10}$	106	6	4	8 at 2*s.* $8\frac{3}{4}$*d.*
6*d.*	$\frac{1}{4}$	10	12	0	
2*d.*	$\frac{1}{3}$	2	13	0	
$\frac{1}{2}$	$\frac{1}{4}$	0	17	8	
$\frac{1}{4}$	$\frac{1}{2}$	0	4	5	
		0	2	2	
		14	9	3	
		0	0	$10\frac{3}{4}$	
		0	0	$10\frac{3}{4}$	
		0	0	$1\frac{1}{2}$	
	Ans.	14	11	2	

(26) *fe.* *in.*

First	8	3	0
	6	6	0
	49	6	0
	4	1	6
	9)53	7	6

5*s.*	$\frac{1}{4}$	5	8	7	6 at 6*s.* $7\frac{1}{2}$*d.*
1*s.*	$\frac{1}{5}$	1	5	0	
6*d.*	$\frac{1}{2}$	0	5	0	
$1\frac{1}{2}$	$\frac{1}{4}$	0	2	6	
		0	0	$7\frac{1}{2}$	
		0	3	$3\frac{3}{4}$	
		0	2	$2\frac{1}{2}$	
		0	0	$8\frac{3}{4}$	
		0	0	1	
	Ans.	1	19	$5\frac{1}{2}$	

		fe.	*in.*	
(27)	First	27	10	0
		14	9	0
		389	8	0
		20	10	6
		9)410	6	6

2*s.* is	$\frac{1}{10}$	45	5	6	6 at 3*s.* 2*d.* per yard.
1*s.*	$\frac{1}{2}$	4	10	0	
2*d.*	$\frac{1}{6}$	2	5	0	
		0	7	6	
		0	1	7	
		0	0	$6\frac{1}{4}$	
	Ans.	7	4	$5\frac{1}{4}$	

		fe.	*in.*
(28)	First	68	6
		5	6
		342	6
		34	3
		9)376	9 area of the foot-way.

2*s.* is	$\frac{1}{10}$	41	7	9	at 3*s.* 6*d.*
1*s.*	$\frac{1}{2}$	4	2	0	
6*d.*	$\frac{1}{2}$	2	1	0	
		1	0	6	
		7	3	6	
		0	2	4	
		0	0	8	
		7	6	6	

	fe.	in.	
	68	6	0
	42	9	0
	2877	0	0
	51	4	6
	2928	4	6=area of the court-yard.
	376	9	0=area of the foot-way.
9)	2551	7	6

2*s*. is	$\frac{1}{12}$	283 4	7	6	at 3*s*. per yard.
1*s*.	$\frac{1}{2}$	28	6	0	
		14	3	0	
		42	9	0	
		0	1	$6\frac{1}{2}$	
		42	10	$6\frac{1}{2}$	
		7	6	6	
	Ans.	49	17	$0\frac{1}{2}$	

		fe.	in.	
(29)	First	21	8	0
		14	10	0
		303	4	0
		18	0	8
	9)	321	4	8

6*d*. is	$\frac{1}{2}$	35	6	4	8
3*d*.	$\frac{1}{2}$	17	6		
1*d*.	$\frac{1}{3}$	8	9		
		2	11		
		0	7		
Ans.		1	9	9	

	fe.	*in.*	
(30) First	83	8	=height and compass of the room.
	12	6	
	1004	0	
	41	10	
	1045	10	=116,2037 yards, at 6*s.* per yard, is £34,86111=34*l.* 17*s.* $2\frac{1}{2}$*d.*

	fe.	*in.*	
Again,	7	8	height } of the shutters.
	3	6	breadth }
	23	0	
	3	10	
	26	10	
		3	
	2)80	6	=surface of 3 shutters.
	40	3	=4*yds.* 4*feet.* 3 *in.* = half work at 6*s.* is 1*l.* 6*s.* 10*d.*

	fe.	*in.*	
Again,	3	6	breadth of the door.
	7	0	=height of ditto.
	2)24	6	
	12	3	=1*yd.* 3*fe.* 3*in.* at 6*s.* is 8*s.* 2*d.*

Then 34*l.* 17*s.* $2\frac{1}{2}$*d.*+1*l.* 6*s.* 10*d.*+8*s.* 2*d.*=36*l.* 12*s.* $2\frac{1}{2}$*d.* *Ans.*

3. *Measuring by the Square of* 100 *Feet, as Flooring, Partitioning, Roofing, Tiling, &c.*

	fe.	*in.*		
(31) First	173	10		=length.
	10	7		=height.
	1738	4	0	
	101	4	10	
	1839	8	10	=18*sq.* 39*fe.* 8*in.* 10*pa.* *Ans.*

		fe.	in.		
(32)	First	20	8		length } of the house.
		16	9		breadth }
		330	8	0	
		15	6	0	
		346	2	0	surface of the first floor.
				4	
		1384	8	0	surface of them all.

fe.	in.	
4	6	breadth.
6	0	length.
27	0	
	2	
54	0	surface of the two first fire-places.

fe.	in.	
5	4	
6	0	
32	0	
	2	
64	0	surface of the second two ditto.

fe.	in.		
5	8		
4	8		
22	8		
3	9	4	
26	5	4	
		2	
52	10	8	surface of the third two fire-places.

fe.	in.	
5	2	
4	0	
20	8	surface of the seventh fire-place.

fe.	*in.*	
10	6	
8	9	
84	0	
7	10	6
91	10	6
		4 floors.
367	6	0=area taken up by the well-hole

fe.	*in.*	*p.*
367	6	0
54	0	0
64	0	0
20	8	0
52	10	8
559	0	8=sum of all the areas of the fire-places, &c.

	fe.	*in.*	*p.*
Then from	1384	8	0
Take	559	0	8
	825	7	4=8*sq.* 25*fe.* 7*in.* 4*p.* at 6*l.* 10*s.* per square, is 53*l.* 13*s.* 3½*d.* *Ans.*

	fe.	*in.*	
(33) First	52	8	length } of the house.
	30	6	breadth }
	1580	0	
	26	4	
	1606	4=area within the walls.	
	803	2=half ditto.	
	2409	6=24*sq.* 9*fe.* 6*in.* at 10*s.* 6*d.* per square, comes to 12*l.* 12*s.* 11¾*d.* + *Ans.*	

	fe.	*in.*		
(34) First	43	10		length } of the barn.
	27	5		breadth }
	1183	6		
	18	3	2	
	1201	9	2=area.	
	600	10	7=half ditto.	
Surface of eave- }	1802	7	9 sum.	
boards add. }	116	10	8	
	1919	6	5	

fe.	*in.*	
43	10	
2	8=16*in.*×2	
87	8	
29	2	8
116	10	8

Then 19 *sq.* 19 *fe.* 6 *in.* 5 *p.* at 25*s.* 6*d.* comes to 24*l.* 9*s.* 5½*d.*+*Ans.*

4. *Measuring by the Rod.*

(35) First $\frac{4085\times 2\frac{1}{2}\times 2}{3}=\frac{20425}{3}$=6808,3, then 6808,3 ÷272,25=25+rods, *Ans.*

	fe.	*in.*
(36) First	254	0
	12	7
	3048	0
	148	2
	3196	2=area.

Then $\frac{3196,16\times 3\times 2}{3}$= 6392,33, then 6392,3÷272,25=23*r.* 130*f.* 7*in.* nearly, *Ans.*

	fe.	*in.*
(37) First	62	6
	14	8
	875	0
	41	8
	916	8=area.

Then $\frac{916,6 \times 2\frac{1}{2} \times 2}{3} = 1527,7$, and $1527,7 \div 272,25 =$ 5ro. 166 *fe.* 6,3 *in.* *Ans.*

	fe.	*in.*
(38) First	28	10
	20	0
	576	8=576,6

Then $\frac{576,6 \times 2\frac{1}{2} \times 2}{3} = 961,1$ = area of first height.

Secondly,	28	10
	20	0
	576	8=576,6

Then $\frac{576,6 \times 2 \times 2}{3} = 768,8$ = area of the second height.

	fe.	*in.*	
Thirdly,	28	10	
	15	8	
	432	6	
	19	2	8
	451	8	8=451,72 *fe.* = area of the third height.

Fourthly, $\frac{42}{4}$ courses of bricks$=10{,}5=10$*fe.* 6 *in.*

fe.	*in.*
28	10
10	6
288	4
14	5
302	9$=302{,}75$*feet.*

Then $\frac{302{,}75\times1\times2}{3\times2}=100{,}916=$area of the gable end.

	feet.
Then	961,111
	768,888
	451,722
	100,916
	2282,638

2282,638 sum of the areas, and $\frac{2282{,}638}{272{,}25}$ *feet* $=$ 8,384345 *rods*, and $8{,}384345\times£5{,}8=£48{,}6292=$ 48*l.* 12*s.* 7*d.*+*Ans.*

5. *How to multiply several Figures by several, and the Product to be produced in one Line only.*

(1) Multiply 35234
By 52424

Product 1847107216

EXPLANATION.

First, $4\times4=16$, that is 6 and carry 1. Secondly, $\overline{3\times4+4\times2}$, and 1 carried$=20+1=21$, that is set down 1 and carry 2. Thirdly, $\overline{2\times4+3\times2+4\times4}$ and 2 carried$=32$, that is 2 and carry 3. Fourthly, $\overline{5\times4+2\times2+3\times4+4\times2}$ and 3 carried is $=47$, set down 7 and carry 4.

Fifthly, $\overline{3\times4}+\overline{5\times2}+\overline{2\times4}+\overline{3\times2}+\overline{4\times5}$, and 4 carried is $=60$, set down 0 and carry 6. Sixthly, $\overline{3\times2}+\overline{5\times4}+\overline{2\times2}+\overline{3\times5}$, and 6 carried is $=51$, set down 1 and carry 5. Seventhly, $\overline{3\times4}+\overline{5\times2}+\overline{2\times5}+$, and 5 carried is $=37$, set down 7 and carry 3. Eighthly, $\overline{3\times2}+\overline{5\times5}+$, and 3 that is carried is $=34$, set down 4 and carry 3. Lastly, $\overline{3\times5}$, and 3 carried is 18, which set down, and the work is finished.

PART V.

THE MENSURATION OF CIRCLES, &c.

Before we begin the solutions of these problems, we shall put a=area, d=diameter, p=periphery, then we shall have the following theorems for solving all the cases proposed about the circle.

Theorem 1. $a=\frac{d}{2}\times\frac{p}{2}$. Theorem 4. $a=0,7854d^2$.

2. $p=3,1416d$. 5. $a=0,0795776p^2$.

3. $d=0,3183p$. 6. $d=\sqrt{1,273239a}$.

Theorem 7. $\sqrt{12,56637a}=p$. $(=\sqrt{\frac{4a}{p}}$.

(1) By the first theorem $\frac{22,6}{2}\times\frac{71}{2}=401,15$ area, *Ans.*

(2) By the second theorem $3,1416\times22,6=71,0016$, the circumference, *Ans.*

(3) By the third theorem $0,3183\times71=22,5993$, the diameter, *Ans.*

(4) By the fourth theorem $0,7854\times\overline{22,6}|^2=0,7854\times 510,76=401,150904$ area, *Ans.*

(5) By the 5th theor. $0,0795776 \times \overline{71}|^2 = 0,0795776 \times 5041 = 401,15068$ the area, *Ans.*

(6) First when the diameter is 1, then the area is ,7854, then $\sqrt{,7854} = ,8862$, therefore As 1 : 0,8862 : : 22,6 : 20,02812 side of the square, *Ans.*

(7) First when the circumference is 1, the side of the square equal is $,28209 = \frac{1}{2}\sqrt{,3183}$, then as 1 : ,28209 : : 71 : 20,02839=side of the square equal, *Ans.*

(8) First if the diameter is 1, the side of the square inscribed in that circle will be $\sqrt{\frac{1}{2} \times \frac{1}{2} \times \frac{2}{1}} = \sqrt{\frac{2}{4}} = \sqrt{,5} = ,707106$, then as 1 : ,707106 : : 22,6 : 15,98059 side of inscribed square, *Ans.*

(9) First if the circumference is 1, the side of the inscribed square will be, $,3183\sqrt{,5} = ,22507$, then as 1 : ,22507 : : 71 : 15,97997 side of the square inscribed. *Ans.*

(10) By the sixth theorem $\sqrt{1,2732 \times 401,15} = \sqrt{510,74418} = 22,599$ the diameter, *Ans.*

(11) By the seventh theorem $\sqrt{12,56637 \times 401,15} = \sqrt{5040,999} = 71$ nearly, *Ans.*

(12) By the aforesaid remarks we have, As 1 : 401,15 : : $,3183 \times 2 = ,6366$: 255,372 the root of which is 15,98, side of the square, *Ans.*

(13) By the above we have, As 1 $\sqrt{2} = 1,4142$: : 15,98 : 22,5928 the diameter sought, *Ans.*

(14) As 1 : 1,12837 : : 22,5928 the diameter required, *Ans.*

(15) As 1 : 4,443 : : 15,98 : 70,999, or 71, nearly the circumference, *Ans.*

(16) As 1 : 3,545 : : 20,028 : 71 the circumference, *Ans.*

Of the Semicircle, and of the Quadrant.

By theorem 1. Find the area of the whole circle, then the half of it will be the area of the semicircle, and the fourth part the area of the quadrant.

EXAMPLE.

If the diameter is 22,6, and the circumference 71, what is the area of the semicircle, and also of the quadrant. By theorem 1. $\frac{22,6}{2} \times \frac{71}{2} = 401,15$ = area of the whole circle, then $401,15 \div 2 = 200,575$ = area of the semicircle; and $401,15 \div 4 = 100,2875$ = area of the quadrant.

To find the Solidity of a Sphere or Globe.

(1) When the diameter is known, put d = diameter, then theorem 1. $0,5236 \times d^3$ = solidity.

(2) When the circumference is known, put c = circumference, then theorem 2. $0,016887 \times c^3$ = solidity.

(3) When the superficies and diameter are known, put s = superficies, then theorem 3. $s \times \frac{d}{6}$ = solidity.

(4) When the superficies and circumference are known, then theorem 4. $0,05305 \times cs$ = solidity.

EXAMPLE.

(1) What is the solidity of a sphere or globe, whose diameter is 10? By theorem 1. $0,5236 \times \overline{10}|^3 = 523,6$ solidity, *Ans.*

(2) What is the solidity of a globe, whose circumference is 31,416? By theorem 2. $0,016887 \times \overline{31,416}|^3 = 523,6$ the solidity, *Ans.* as before.

(3) What is the solidity of a globe, whose superficies is 314,16, and its diameter 10? By theorem 3, then $314,16 \times \frac{10}{6} = 523,6$ solidity as before, *Ans.*

(4) What is the solidity of a globe, whose superficies is 314,16, and its circumference is 31,416. By theorem 4. $314,16 \times 31,416 \times 0,05305 = 523,585$, the solidity, the same as in the three other examples nearly; which shows the use and truth of the four theorems, as all the four questions produce the same *Ans.*

PART VI.

SOLUTIONS TO THE COLLECTION OF QUESTIONS.

(1) First $254 \times 14 \times 4\frac{1}{2}d. = 3556 \times 4\frac{1}{2}d. = 16002d. =$ $66l.$ $13s.$ $6d.$ *Ans.*

(2) First £$320 \times 5 = 1600$ = A's stock and time.
$460 \times 3 = 1380$ = B's stock and time.

Sum 2980

$$\text{Then as } 2980 : £100 :: \begin{Bmatrix} 1600 \\ 1380 \end{Bmatrix} : \begin{Bmatrix} £.\ 53 & s.\ 13 & d.\ 9\frac{270}{298} \\ 46 & 6 & 2\frac{28}{298} \end{Bmatrix} \textit{ Ans.}$$

(3) First $13cwt.$ $2qrs. = 54qrs. = 1512lb.$ at $14d.$ per $lb.$ then $1512 \times 14 = 21168d. = 1764s. = 88l.$ $4s.$ price of the wool, then as $17s.$ $6d.$: $1yd.$ :: $88l.$ $4s.$: $\frac{1764 \times 2}{35} = \frac{3528}{35}$ $= \frac{504}{5} = 100$ *yds.* $3\frac{1}{5}$*qrs. Ans.*

(4) First £$90 +$ £$10 =$ £100. $1000 \times 3 = 3000$ *qrs.* then as 3000*qrs.* : £100 :: 5*qrs.* : $\frac{500}{3000} = \frac{5}{30} =$ £$\frac{1}{6} =$ $3s.$ $4d.$ *Ans.*

(5) First as $14s.$: $16s.$ :: £42 : £48 advanced price of one tun of B's wine. Again, $648 \times 16s. = 2592 \times 4 =$ $10368s. = 508l.$ $8s.$ = advanced value of A's cloth; then as £48 : 1 *tun* :: $518l.$ $8s.$: $\frac{10368}{960} = \frac{1296}{120} = 10$ *tun* 3 *hhds.* $12\frac{3}{5}$ *gal. Ans.*

(6) First $876 \times 16\frac{1}{2}s. = 14454s. = 722l.$ $14s.$ then £1200 $- 722l.$ $14s. = 477l.$ $6s.$ $0d.$ *Ans.*

		cwt.	qr.	lbs.	
(7) First 16*lb.*	$\frac{1}{7}$	417	1	15	gross.
4	$\frac{1}{4}$	59	2	14	
		14	3	17	
		74	2	3	tare.
	Neat	342	3	12	=38400*lb.*

Then as $7\frac{1}{2}$*lb.* : 1 *gal.* : : 38400 *lb.* : 5120 *gal. Ans.*

(8) If 14*s.* 6*d.* : £100 : : 16*s.* 9*d.* : $\frac{3350}{29}$ = 115*l.* 10*s.* 4*d.* $\frac{4}{29}$, then 115*l.* 10*s.* 4*d.* $\frac{4}{29}$ − £100 = 15*l.* 10*s.* 4*d.* $\frac{4}{29}$, *Ans.*

		lb.	
(9) First	84,75*lb.* × 27 =	2288,25	the gross weight.
	1,375 × 27 =	37,125	the tare.
	26)	2251,125	suttle.
		86,5817	tret.
		2164,5433	neat weight, which

at $8\frac{1}{2}$*d.* per *lb.* comes to 18398,61805*d.* = 76*l.* 13*s.* $2\frac{1}{2}$*d.* ,47, *Ans.*

(10) If $\frac{2}{3}$*oz.* : $\frac{7}{8}$*s.* : : $\frac{5}{6}$*lb.* × $\frac{16}{1}$: $\frac{7\times 80\times 3}{8\times 6\times 2}=\frac{1680}{96}=\frac{140}{8}=$ 17*s.* 6*d. Ans.*

(11) If $\frac{5}{68}$*gal.* : £$\frac{5}{8}$: : $\frac{5}{9}$ × $\frac{252}{1}$ $\frac{6\times 5\times 1260}{5\times 6\times 9}=\frac{7560}{72}=\frac{1890}{18}$ $=\frac{210}{2}=$ £105, *Ans.*

(12) First 1*l.* 7*s.* $10\frac{1}{2}$*d.* = £1,39375. As 1 *day* : £1,39375 : : 365 *days* : £508,71875, then £508,71875 + £340 = 848*l.* 14*s.* $4\frac{1}{2}$*d. Ans.*

		lb.	*oz.*
(13) First	13 × $19\frac{1}{2}$ × 112 =	28392 =	454272
	And 388*lb.* × 39 =	15132 =	242112
		Ans.	212160 ounces.

(14) First £1360÷5=£272 = captain's share, and £1360 − £272 = £1088, then £1088÷160 = 6*l.* 16*s.* each man's share, *Ans.*

(15) First $\frac{£1314-£956}{956\times7\frac{1}{2}}=\frac{358}{7170}=\frac{35,8}{717}=,05$, or £5 the rate per cent, *Ans.*

		£.	s.	
(16) First	£13×7=91		0	4*l.* 12*s.* the difference, *Ans.*
	£3. 12*s*×24=86		0	

(17) First suppose A's share £1, then B's is £2, and C's share £3; their sum is £6; then say, As £6 : £120 :: £1 : £20=A's share, and £20×2=£40=B's share, and £20+£40=£60=C's share, *Ans.*

(18) First 3+5+8=£16.

$$\text{If } £16 : £1000 :: \begin{cases} 3 : \dfrac{3000}{16} = 187 \;\; 10 \\ 5 : 5000 \div 16 = 312 \;\; 10 \\ 8 : 8000 \div 16 = 500 \;\; 0 \end{cases} \quad (£.\ s.)$$

		£.	s.	d.
Ans.	A's share is	187	10	0
	B's share is	312	10	0
	C's share is	500	0	0

(19) Here 8 6 6=length } of the wainscot.
2 9 9=breadth }

17	1	0	0	
6	4	10	6	
0	6	4	10	6
24	0	3	4	6=superficial content, *Ans.*

(20) First reciprocally, As 6*mon.* : 360*men* :: 5*mon.* : 432*men*, then 432*men* − 360*men*=72 men kept, and 360 − 72 = 288 men departed, *Ans.*

Or thus, 6*mo.* − 5*mo.*=1*mo.* reciprocally. As 1*mo.* : 360*men* :: 5*mo.* : 72*men*, then 360 − 72=288 men, *Ans.*

(21) First 187+34=221=greater number, then 187× 221=41327, and 41327×41327=1707920929=square of the product, *Ans.*

(22) First £11 + £2 + £1,25 + £1,75 = £16, then £$\frac{216}{16}$ = 13 of each and £8 over, *Ans.*

(23) First $11\frac{5}{7} = 11\frac{440}{616}$, then $36\frac{337}{616} - 11\frac{440}{616} = 24\frac{513}{616}$, *Ans.*

(24) First $11\frac{9}{17} = \frac{196}{17}$, then $\frac{196}{17} \div \frac{3}{7} = \frac{196}{17} \times \frac{7}{3} = \frac{1372}{51} = 26\frac{46}{51}$, *Ans.*

(25) First 179 × 13 = 2327*cwt.* then if 1*cwt.* : 2*l.* 7*s.* 1*d.* :: 2327*cwt.* : 5478*l.* 2*s.* 11*d.* *Ans.*

(26) First 500*l.* 13*s.* 6*d.* × $3\frac{1}{2}$ = 1752*l.* 7*s.* 3*d.* then 1752*l.* 7*s.* 3*d.* ÷ 100 = 17*l.* 10*s.* $5\frac{1}{2}$*d.* $\frac{68}{100}$, *Ans.*

(27) First 6 ÷ 3 = 2, and 20 ÷ 4 = 5, then as 2 : 3 :: 5 : $\frac{15}{2} = 7\frac{1}{2}$, *Ans.*

(28) First 3*qrs.* 14*lb.* = 98*lb.* then 98 ÷ 112 = ,875, the decimal, *Ans.*

(29) First 8*s.* 8*d.* × 60 = 104*d.* × 60 = 6240*d.* value of the inkle, then 6240 ÷ $4\frac{1}{2}$ = $1386\frac{2}{3}$*lb.* of sugar, *Ans.*

(30) As 9*d.* : £100 :: $13\frac{1}{2}$*d.* : £150, then £150 − £100 = £50 gain per cent. *Ans.*

```
            lb.    d.
(31) Here 20 ×  9 = 180 }
          60 × 12 = 720 } value of the different mix-
          40 × 18 = 720 }   tures.
          12 × 24 = 288 }
          ———     ———
          132    )1908 (14¼d. 9/11 = 1s. 2¼d. 9/11 value of
                  1848      a lb. of this mixture, Ans.
                  ———
                    60
                     4
                  ———
                   240 (¼
                   132
                  ———
                   108
                  ═══
```

(32) First $28\times2=56$ twice twenty-eight, and $\overline{8\times2+20}=36$ twice eight-and-twenty, then $56-36=20$ their difference; again $55\times2=110$ twice fifty-five, $\overline{5\times2+50}=60$ twice five-and-fifty, then $110-60=50$ other difference, then the *Ans.* 20 and 50.

(33) First a noble and a mark are 13*s.* 4*d.*+6*s.* 8*d.*= 20*s.*=£1 then as £1 : 15 *yds.* : : £50 : $50\times15=750$*yds.* $=\frac{750\times4}{5}=600$ *ells*, *Ans.*

(34) First $£650\times400\div100=£2600$, and $130\times400\div100=£520$, then $£2600-£520=£2080$ the whole loss, *Ans.*

(35) First, As 6*s.* : 9*d.* : : 6*s.* 6*d.* : $9\frac{3}{4}$*d.* advanced price of the cotton. As 1 *doz.* : 6*s.* 6*d.* : : 100*doz.* : 650*s.* advanced value of the candles. Again, as $9\frac{3}{4}$*d.* : 1*lb.* of cotton : : 650*s.* =7800*d.* : 800*lb.*=7 *cwt.* 0*qr.* 16*lb.* of cotton, *Ans.*

(36) As 365 *days* : £73 : : 1 *day* : $\frac{73\times20}{365}=\frac{1460}{365}=4s.$ per day, *Ans.*

(37) As £53 : 5*s.* 10*d.* : : £100 : $\frac{29l.\ 3s.\ 4d.}{53}=\frac{583..4}{53}$ =11*s.* 0*d.* $\frac{4}{53}$ what C ought to pay, *Ans.*

(38) First $100\div3=33\frac{1}{3}s.$ and $100\div2=50s.$ then $50s.+33\frac{1}{3}s.=83\frac{1}{3}s.$ what the ribands were bought for. Again, As 5 *yds.* : 2*s.* : : 200 *yds.* : $\frac{200\times2}{5}=\frac{400}{5}=80s.$ what the ribanding was sold for, then $83\frac{1}{3}s.-80s.=3s.\ 4d.$ loss, *Ans.*

(39) Here $\frac{3}{5}+\frac{1}{8}=\frac{24}{40}+\frac{5}{40}=\frac{29}{40}$, *Ans.*

(40) Here 30*d.* $\left\{\begin{array}{l}48 \text{———————————} 6\\36 \text{—┐ ——————} 6\\24 \text{—┘ } 18+6=24\end{array}\right\}$ quantities of each, that is, 6 of rye, 6 of barley, and 24 bushels of oats, *Ans.*

(41) As $\frac{3}{8}$: £3740 : : 1 : $3740\times\frac{8}{3}\frac{29920}{3}=9973l.\ 6s.\ 8d.$ *Ans.*

(42) As $5s.\ 4d. : 1 gal. :: 62l.\ 8s. : \frac{1248 \times 12}{64} = \frac{14976}{64} =$ $= 234$ gallons, *Ans.*

(43) First 880 guineas $=$ £924. $924 \div \frac{3}{20} = \frac{18480}{3} =$ £6160, then £6160 $+$ £2200 $=$ £8360 $= \frac{4}{5}$ of his fortune, and as $\frac{4}{5}$: £8360 :: $8360 \times \frac{5}{4} = \frac{41800}{4} =$ £10450 $=$ his fortune at first, *Ans.*

(44) First $\frac{1}{3} + \frac{1}{4} + \frac{1}{6} = \frac{4}{12} + \frac{3}{12} + \frac{3}{12} = \frac{9}{12} = \frac{3}{4}$, and $1 - \frac{3}{4} = \frac{1}{4}$, then as $\frac{1}{4}$: £28 :: 1 : $28 \times 4 =$ £112, *Ans.*

(45) By simple interest $1000 \times ,0475 \times 5,5 = 261l.\ 5s.$ $=$ interest, then £1000 $+ 261l.\ 5s = 1261l.\ 5s.\ 0d.$ amount, *Ans.*

(46) First the amount of £100 at £5 per cent. for 4 months, is £$101\frac{2}{3} = \frac{305}{3}$, then as $\frac{305}{3}$: £100 :: $\frac{700}{2}$: $\frac{35000 \times 3}{305} =$ £$\frac{21000}{61}$ present worth of the first payment. Again, the amount of £100 at £5 per cent, for 8 months, is £$103\frac{1}{3} =$ £$\frac{310}{3}$, then as $\frac{310}{3}$: £100 :: £350 : $\frac{35000 \times 3}{310}$ $= \frac{105000}{310} =$ £$\frac{10500}{31}$ present worth of the second payment, then $\frac{21000}{61} + \frac{10500}{31} = \frac{1291500}{1891} = 682l.\ 19s.\ 5\frac{1}{4}d.\ \frac{177}{1891}$, *Ans.*

(47) If $18 fe. : 30 fe. :: \frac{3}{4} \times \frac{3}{1} = \frac{9}{4} fe. : \frac{18 \times 30 \times 4}{9} = \frac{2160}{9} =$ $240 fe. = 80 yds.$ *Ans.*

(48) First $19312 \times \frac{5}{3} = \frac{96560}{3} =$ £$32186\frac{2}{3}$ $=$ two years' rent, then $\frac{32186\frac{2}{3}}{2} =$ £$16093\frac{1}{3} = 16093l.\ 6s.\ 8d.$ a year, *Ans.*

(49) First $6d.+8d.+16d.=30$, then $\frac{50s.\times 12}{30}=\frac{600}{30}=$ 20 the number of each, *Ans.*

(50) First

	fe.	*in.*		
	4	6		long.
	2	9		broad.
	9	0		
	3	4	6	
	12	4	6	
	3	4	0	depth.
	37	1	6	
	4	1	6	
	41	3	0	solidity.

Ans. 41*fe.* 8*in.*

(51) First $22s.\ 6d.\times 640=$ £720 their pay per month, then £$720\times 32mo.=$ £23040, *Ans.*

(52) First 500 crowns at 4*s.* 6*d.* comes to 112*l.* 10*s.* and 500 halfpence $=1l.\ 0s.\ 10d.$ then $112l.\ 10s.-1l.\ 0s.\ 10d.=111l.\ 9s.\ 2d.$ *Ans.*

(53) First £100 − £60 = £40 = B's gain, then as £40 : £640 : : £60 : £960 = C's stock, *Ans.*

(54) As £5 : £100 : : £20 : £400 principal, *Ans.*

(55) First $672\times 2s.\times 2=2688$, and $17s.\ 6d.\times 2=35$, then $2688\div 35=76\frac{28}{35}=76\frac{4}{5}$ French pistoles, *Ans.*

(56) First 1*cwt.* 2*qrs.* 5*lb.* $\times 7=$ 10*cwt.* 3*qrs.* 7*lb.* = 43*qrs.* 7*lb.* = 1211*lb.* = 19376*oz.* = 310016*dr.* the weight of the 7 cheeses, and 5*oz.* 7*dr.* = 87*dr.* then $310016\div 87=3563\frac{35}{87}$ allowances, *Ans.*

(57) It is evident that the number required is equal to $48+72+19+7+12=158$, *Ans.*

(58) First $\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}+\frac{1}{7}=\frac{2754}{2520}=\frac{459}{420}=\frac{153}{140}$.

As $\frac{153}{140}$: £500 : : $\left\{\begin{array}{l}\frac{1}{3}\ \text{£}152\frac{232}{459}=\text{A's} \\ \frac{1}{4}\ \text{£}114\frac{174}{459}=\text{B's} \\ \frac{1}{5}\ \text{£}\ 91\frac{231}{459}=\text{C's} \\ \frac{1}{6}\ \text{£}\ 76\frac{116}{459}=\text{D's} \\ \frac{1}{7}\ \text{£}\ 65\frac{165}{459}=\text{E's}\end{array}\right\}$ share, *Ans.*

(59) Suppose the man 36 years of age, then the woman would be 12, then at the end of 15 years the man will be 51, and the woman 27. As 1 : 2 : : 27 : 54, but should be 51, therefore the first error is 3. Again, suppose the man 42 years of age, then the woman must have been 14, and at 15 years the man would be 57, and the woman 29; then as 1 : 2 : : 29 : 58, but should be 57, then the error is 1; here the errors are alike, then by the rule $\frac{\overline{42\times3}-\overline{36\times1}}{3-1}$ $=\frac{90}{2}=45$ years the man's age, and 15 years the woman's age, *Ans.*

(60) First, As $3\frac{1}{3}$ acres : 12 oxen : : 10 acres : 36 oxen, which 10 acres will keep in 4 weeks. Inversely, As 4 weeks : 36 oxen : : 9 weeks : 16 oxen to be kept in 9 weeks ; then
Or 8 oxen in 18 weeks.
21—16=5 oxen. Inversely, As 9 weeks : 5 oxen : : 18 weeks : $2\frac{1}{2}$ oxen in 18 weeks ; again, 18 weeks—4 weeks =14 weeks, and 9—4=5 weeks. Inversely, as 14 weeks : $2\frac{1}{2}$ oxen : : 5 weeks : 7 oxen, then 7 oxen+8 oxen=15 oxen. Lastly, As 10 acres : 15 oxen : : 24 acres : 36 oxen, *Ans.*

Having gone through the Miscellaneous Questions, we proceed to the Solutions of the remaining Questions about Interest, &c. by our Author's Table.

1. *To find the Interest of any Sum of Money for any Number of Months, Weeks, or Days, at any Rate per Cent. by the Table.*

	£.	s.
(1)	2467	10
		4
	9870	0
	10 months.	
	987|00	

	£.	s.	d.
Then against 900 in the table stands	75	0	0
80.................	6	13	4
7.................	0	11	8
987 *Ans.*	82	5	0 interest required.

	£.	s.
(2)	2467	10
		5
	12337	10
		12 weeks.
	1480|50	0

	£.	s.	d.
Then 1000 =	19	4	$7\frac{1}{4}$
400 =	7	13	10
80 =	1	10	$9\frac{1}{4}$
,50 =	0	0	$2\frac{1}{2}$
1480,50 =	28	9	5 interest, *Ans.*

	£.	s.
(3)	2467	10
		6
	14805	0
		50 days.
	7402|50	

	£.	s.	d.
Then 7000 =	19	3	$6\frac{1}{2}$
400 =	1	1	11
2 =	0	0	$1\frac{1}{4}$
,50 =	0	0	$0\frac{1}{4}$
7402,50 =	20	5	7 interest, *Ans.*

2. *To find what an Estate from £1 to £60,000 per will come to for one Day.*

		£.	s.	d.
(4) For	300 =	0	16	$5\frac{1}{4}$
	70 =	0	3	10
	6 =	0	0	4
	376	1	0	$7\frac{1}{4}$ *Ans.*

3. ***To find the Amount of an Income, Salary, or Servants' Wages, for any Number of Months, Weeks, or Days.***

(5) For 11 Months.

		£.	s.	d.
270	2000=	166	13	4
11	900=	75	0	0
	70=	5	16	8
2970				
	2970=	247	10	0

For 3 Weeks.

		£.	s.	d.
270	For 800=	15	7	$8\frac{3}{4}$
3	10=	0	3	$10\frac{1}{4}$
810	810=	15	11	$6\frac{1}{2}$

For 6 Days.

		£.	s.	d.	
270	1000=	2	14	$9\frac{1}{2}$	
6	600=	1	12	$10\frac{1}{2}$	
	20=	0	1	$1\frac{1}{4}$	
1620					
	1620=	4	8	$9\frac{1}{4}$	*Ans.*

For the whole Time.

£.	s.	d.	
247	10	0	
15	11	$6\frac{1}{2}$	
4	8	$9\frac{1}{4}$	
267	10	$3\frac{3}{4}$	*Ans.*

RULES

FOR THE MANAGEMENT OF

CIRCULATING DECIMALS.

REDUCTION.

To reduce a pure Repetend to its equivalent Vulgar Fraction.

$\frac{\dot{1}\dot{4}}{99}=\frac{14}{99}$ $\frac{\dot{7}9216}{99999}=\frac{79216}{99999}$ $\frac{\dot{4}1\dot{3}}{999}=\frac{413}{999}$

$\frac{,\dot{0}09\dot{1}}{9999}=\frac{91}{9999}$

$\frac{\dot{6}1375}{99999}=\frac{61375}{99999}$ $\frac{4700\dot{2}}{99999}=\frac{\dot{4}7002}{99999}$ $\frac{0\dot{1}2\dot{5}}{9999}=\frac{,0125}{9999}$

$\frac{\dot{2}74\cdot3\dot{4}}{99999}=\frac{27434}{99999}$

CASE II.

To reduce a mixed Repetend to a Vulgar Fraction.

$\frac{11\dot{8}5\dot{0}-11}{99900}=\frac{11839}{99900}$

$74+\frac{048-04}{900}=74+\frac{044}{900}=74,\frac{11}{225}$

$\frac{4\dot{1}\dot{6}-4}{990}=\frac{412}{990}=\frac{206}{495}$

$\frac{14285\dot{7}-14285}{900000}=\frac{128572}{900000}=\frac{32143}{225000}$

$3\frac{\dot{5}1\dot{8}}{999}=3\frac{518}{999}$

$$\frac{42\dot{1}75-42}{99900}=\frac{42133}{99900}=\frac{42133}{99900}$$

$$12\frac{3\dot{7}\dot{5}-3}{990}=12\frac{372}{990}=\frac{186}{495}$$

To find the least common Multiple of several Numbers.

EXAMPLE 1.—As 2 and 4 are either of them commensurable by 2, let one of them be divided by it $\frac{2}{2}=1$ this quotient multiplied by the remaining numbers, for which no common divisor can be found, $1\times4\times5\times7=140$, *Ans.*

EXAMPLE 2. $3\times7=21\div21=1\times21=21\times4=84\div4=21\times8=168$, *Ans.*

ADDITION.

CASE I.

When the Decimals contain a single Repetend.

$$\begin{array}{r} (1)\ \ 4{,}72708\dot{3} \\ 2{,}58333\dot{3} \\ {,}00208\dot{3} \\ 9{,}02916\dot{6} \\ 4{,}03125\dot{0} \\ 17{,}03575\dot{6} \\ \hline 37{,}40867\dot{3} \end{array} \qquad \begin{array}{r} (2)\ \ {,}0833\dot{3} \\ 12{,}5000\ddot{0} \\ 7{,}6080\dot{6} \\ {,}75000 \\ 4{,}0061\dot{3} \\ \hline 24{,}9475\dot{3} \end{array} \qquad \begin{array}{r} (3)\ \ 74{,}61\dot{7} \\ 40{,}01\dot{3} \\ 1{,}25\dot{0} \\ {,}66\dot{6} \\ 02\dot{7} \\ \hline 116{,}57\dot{5} \end{array}$$

$$\begin{array}{r} (4)\ \ 41{,}\dot{3}333\dot{3} \\ {,}1008\dot{6} \\ {,}27000 \\ 4{,}62000 \\ 9{,}66666 \\ \hline 55{,}9908\dot{6} \end{array}$$

CASE II.

When the Decimals contain compound Repetends.

(2)

```
 162,16216216
 134,09090909
   2,93939393
  97,26666666
   3,76923076
  99,08333333
   1,50000000
    ,81481481
 ------------
 501,62651077
```

(3)

```
 ,2954395439543
 ,1041041041041
 ,3737373737373
 ,4065826065826
 ,4731473147314
 --------------
1,6530109431099
```

(4)

```
 ,7045
 ,7954
 -----
1,5000
```

(5)

```
  ,21613000000
50,06363636363
  ,00025000000
 1,33333333333
  ,70370370370
 -------------
52,31705340067
```

(6)

```
 1,13506713
21,21212121
17,30530530
  ,66666666
  ,05000000
 ----------
40,36916031
```

(7)

```
2,937269372693726
1,222222222222222
1,000333333333333
 ,712712712712712
 ,307630763076307
 ----------------
6,180168404038302
```

SUBTRACTION.

(3) $10,0\dot{4}1341\dot{3}$
$,\dot{2}64646\dot{4}$
$9,\dot{7}76694\dot{8}$

(4) $9,173\dot{8}673\dot{8}$
$4.200\dot{1}333\dot{3}$
$4,973\dot{7}3405$

(5) $1,\dot{0}$
$,\dot{3}$
$,\dot{6}$

(6) $4,0\dot{1}2\dot{3}$
$2,\dot{7}03\dot{7}$
$1,308\dot{6}$

(7) $14,\dot{0}4704\dot{7}$
$12,\dot{3}636\dot{3}6$
$1,\dot{6}8241\dot{0}$

MULTIPLICATION.

CASE I.

When the Multiplicand contains a compound Repetend and the Multiplier consists of terminate Numbers.

(3) $91,646\dot{7}$
$426\dot{8}$
$733174\dot{2}$
54988066
183293555
3665871111
$39114,8447\dot{5}$

(4) $40\dot{6}13,5\dot{2}$
2,0068
32490817
243681133
81227044444
$81503,21639\dot{5}$

CASE II.

When the Multiplicand contains a compound Repetend.

(3)

51637
284

206551
4131011
10327527

14,665090

(4)

56,0042941
461,2

1120085882
5600429414
336025764857
2240171765717

25829,18045872

(5)

842543
1004,8

6740347
33701737
8425434254

8465,876338

(6)

37603
29162

75207
2256216
3760360
338432432
752072072

10965,96288

CASE III.

When the Multiplier has a single Repetend.

(4)

14861,6
40,73

9)445848

495386
1040312
594464

605362,506

(5)

,419637
15,7

9)2937463——463, &c.

3263848292737, &c.
2098188188, &c.
4196376376, &c.

6,62094939, &c.

```
(6)  21464,3̇
        12,6
     ---------
   9)1287860̇
     ---------
      1430955̇
      4292866̇
     21464333̇
     ---------
    271881,55̇
    =========
```

CASE IV.

When the Multiplier contains a compound Repetend.

```
(4)   49,273          6,14̇902̇
      6,14̇841̇              61
     --------         --------
        49273          614841
      197092          --------
     394184
    197092
    49273
  295638
  -----------
  30295060593
      3029506
          302
  -----------
  30298090401
  ===========
```

```
(5)     7,0046̇3̇
         ,0041̇3̇
       ---------
        2101390̇
       7004633̇
     280185333
     ----------
     289291356——6
        289291——3
           289——2
     ----------
    ,0289580937, &c.
    ==========
```

(6)

412643	51273
51268	5
3301149	51268
24758618	
82528728	
412643643	
20632182182	

21155414322——3
2115541——4
211——5

21157530075, &c.

(7)

9,24685
46

5548111——48, &c.
36987409——87, &c.

42535521——&c.
425

42535946

(8)

0421643	24,3721
24,2697	24
2951501	242697
37947873	
252985825	
0843286084	
16865721686	
84328684328	

102331577300
10233

1,02331587533, &c.

DIVISION.

CASE I.

When the Dividend contains a single or compound Repetend, the Divisor being terminate Numbers.

(4) 7)461,1752777, &c.

65,88218253969

(5) 11)51,6432843284, &c.

4,694844029, &c.

(6) ,3048),414414, &c.

,135962734, &c.

(7) 8,4461)24,61436814, &c.

2,9142880, &c.

(8) 8,64)4,1414141414

,4793303404, &c.

CASE II.

When the Divisor contains either a single or compound Repetend, the Dividend being terminate Numbers.

(4) 1476 214,1600
14 2,1416

1462)2120184

145,0194254, &c.

(5) 921400
9214

$\dot{8}\dot{3}$) 912186

109,9019277, &c.

(6) 1000000
1000

$\dot{5}1\dot{6}$) 999000

1,930604651, &c.

(7) 754,030
75403

$\dot{7}$) 678627

96,9467142, &c.

CASE III.

When there are either single or compound Repetends in the Divisor and Dividend.

(8) $406,333\dot{3}\dot{3}$ by $1,61\dot{4}5\dot{6}$
40633 161

40592700 161295

161295)40592700 (251,6674416, &c. Quot.

(9) $914,000\dot{1}4141\dot{4}$ by $,4\dot{1}741\dot{7}$
914000

913999227414

,417)913,99227414 (2189,65501, &c. Quot.

(10) 3201,40338 by 7325865
320140 7325

3198,20198 73,18540

73,18540)3198,20198 (43,7 Quot.

(11) 135169533 by 4,2979797
135 42

13,5169398 4,2979755

42979755)13,5169398(3,14495, &c. Quot.

(12) 46,043171271271271 2
460431

46,0431712712252281 dividend.

4216821682168
4

4216821682168 divisor.

1091892, &c. Quot.

N.B. It will be readily seen that several of the preceding examples, both in this rule and Multiplication, are not worked completely out, from the great and unnecessary labour they would require in the calculation.

APPENDIX.

As we have finished the Tutor's Assistant, we shall, as an Appendix, add a few rules, with examples and their solutions, in a short and concise method of casting up any quantity of goods, &c. useful for tradesmen, merchants, and others.

1. *Having the Price of 1lb. to find the Price of 1cwt. or 112lb.*

Rule. Multiply nine shillings and fourpence by the number of pence per lb. the product is the *Ans.*

EXAMPLES.

1. At $5\frac{1}{2}$*d.* per lb. what is the value of an cwt.? 9*s.* 4*d.* $\times 5\frac{1}{2}$ = 2*l.* 6*s.* 8*d.* + 4*s.* 8*d.* = 2*l.* 11*s.* 4*d.* *Ans.*

2. At $9\frac{1}{4}$*d.* per lb. what is the value of an cwt.? 9*s.* 4*d.* $\times 9\frac{1}{4}$ = £4*l.* 4*s.* 0*d.* + 2*s.* 4*d.* = 4*l.* 6*s.* 4*d.* *Ans.*

3. At $11\frac{3}{4}$*d.* per lb. what is the value of an cwt.? 9*s.* 4*d.* $\times 11\frac{3}{4}$ = 5*l.* 2*s.* 8*d.* + 7*s.* 0*d.* = 5*l.* 9*s.* 8*d.* *Ans.*

4. At $19\frac{1}{4}$*d.* per lb. what is the value of an cwt.? 9*s.* 4*d.* $\times 19\frac{1}{4}$ = 8*l.* 17*s.* 0*d.* + 2*s.* 4*d.* = 8*l.* 19*s.* 8*d.* *Ans.*

2. *Having the Price of 1cwt. to find the Price of 1lb.*

Rule 1. Take the tenth part of the price in shillings, and the fourteenth part of this added to it, the sum is the pence for a pound.

Rule 2. Or divide by $4 \times 4 \times 7 = 112$ for the price per pound.

EXAMPLE 1. At 2*l*. 11*s*. 4*d*. per cwt. what is that per lb.? 2*l*. 11*s*. 4*d*.$=51\frac{1}{3}$*s*. then $51\frac{1}{3}\div10=5,13$. $5,13\div14=,36$, this added to 5,13 gives 5,49*d*. or $5\frac{1}{2}$*d*. per lb. *Ans*.

Or thus, $\frac{2l.\ 11s.\ 4d.}{4\times4\times7}=\frac{12s.\ 4d.}{4\times7}=\frac{3s.\ 2\frac{1}{2}d.}{7}=\frac{38\frac{1}{2}d.}{7}=5\frac{1}{2}d.$ same as before.

2. At 4*l*. 6*s*. 4*d*. the cwt. what is that at per lb.? By second rule, 4*l*. 6*s*. 4*d*.$\div\overline{4\times4\times7}=$1*l*. 1*s*. 7*d*.$\div\overline{4\times7}=$ 5*s*. $4\frac{3}{4}$*d*.$\div7=9\frac{1}{4}$*d*. *Ans*.

3. At 1*l*. 12*s*. 8*d*. the cwt. what is the price of 1lb.? 1*l*. 12*s*. 8*d*.$\div\overline{4\times4\times7}=$8*s*. 2*d*.$\div\overline{4\times7}=$2*s*. $0\frac{1}{2}$*d*.$\div7=3\frac{1}{2}$*d*. per lb. *Ans*.

RULE 3. Multiply the price in shillings by 3, divide the product by 7, the quotient is the answer in farthings.

EXAMPLE 2. At 4*l*. 6*s*. 4*d*. the cwt. what is that at per lb.? First 4*l*. 6*s*. 4*d*.$=86\frac{1}{3}$*s*.$\times3\div7=259\div7=37$ farthings$=9\frac{1}{4}$. same as before, *Ans*.

EXAMPLE 3. At 1*l*. 12*s*. 8*d*. the cwt. what is it per lb.? First 1*l*. 12*s*. 8*d*. = 32*s*. 8*d*.$\times32\frac{2}{3}$*s*.$\times\overline{3\times7}=98\div7=14$ farthings$=3\frac{1}{2}$*d*. per lb. *Ans*.

3. *Having the Price of* 1*lb. or* 1*oz. to know what* 100 *will come to.*

RULE 1. Take twice as many shillings, and as many pence as one cost farthings, and add them together for the answer. Or multiply 8*s*. 4*d*. by the price per lb. &c.

EXAMPLES.

1. At $1\frac{1}{4}$*d*. per ounce, what comes 100 ounces to? $1\frac{1}{4}$*d*.=5 farthings, then $\overline{5s.\times2+5d.}=$10*s*. 5*d*. *Ans*.

2. At $10\frac{1}{2}$*d*. per lb. what will 100lb. cost? $10\frac{1}{2}$*d*.=42 farthings, then 42*s*.$\times2+$42*d*.=87*s*. 6*d*.=4*l*. 7*s*. 6*d*. *Ans*.

RULE 2. Multiply 8*s*. 4*d*. by $1\frac{1}{4}$*d*.=8*s*. 4*d*.+2*s*. 1*d*.= 10*s*. 5*d*. the *Ans*. as before.

Multiply 8*s*. 4*d*.$\times10\frac{1}{2}$=4*l*. 3*s*. 4*d*.+4*s*. 2*d*.=4*l*. 7*s*. 6*d*. *Ans*. same as before.

4. *Having the Price of* 100, *to find the Price of* 1.

RULE. Divide the pence in the price per 100 by 100, the quotient is the *Ans.*

EXAMPLES. 1. At 10*s.* 5*d.* per 100, what is the price of 1? First 10*s.* 5*d.* = 125*d.* then $\frac{125}{100}=\frac{25}{20}=\frac{5}{4}=1\frac{1}{4}$*d. Ans.*

2. At 4*l.* 7*s.* 6*d.* per 100lb. what is that per lb.? First 4*l.* 7*s.* 6*d.* = 1050*d.* then $\frac{1050}{100}=\frac{105}{10}=10\frac{1}{2}$*d. Ans.*

5. *Having the Price of* 1, *to know what* 120 *cost.*

RULE. Take half as many pounds as there are pence in one for the price of 120. Or take 10*s.* for every 1*d.* and add thereto 2*s.* 6*d.* for every farthing.

EXAMPLES. 1. Gave $5\frac{3}{4}$*d.* each for fish, how much for 120? Here 10*s.* × 5 + 2*s.* 6*d.* × 3 = 2*l.* 10*s.* + 7*s.* 6*d.* = 2*l.* 17*s.* 6*d. Ans.*

2. Gave $19\frac{1}{2}$*d.* each for 120 deal-boards, what do they come to? 10*s.* × 19 + 2*s.* 6*d.* × 2 = 9*l.* 10*s.* + 5*s.* = 9*l.* 15*s.* *Ans.*

Or thus by the first rule, then $19\frac{1}{2} \div 2 =$ £$9\frac{3}{4}$ = 9*l.* 15*s.* *Ans.* as before.

6. *Having the Price of* 1, *to know what* 1000 *comes to.*

RULE 1. To as many pounds as one cost farthings, add as many tenpences gives the answer.

2. Or multiply 4*l.* 3*s.* 4*d.* by the pence that one cost, the product is the answer.

EXAMPLES. 1. What will 1000 oranges come to at $1\frac{1}{2}$*d.* each? Thus £6 + 10*d.* × 6 = 6*l.* 5*s.* 0*d. Ans.*

Or, 4*l.* 3*s.* 4*d* × $1\frac{1}{2}$*d.* = 4*l.* 3*s.* 4*d.* + 2*l.* 1*s.* 8*d.* = 6*l.* 5*s.* *Ans.* as before.

2. What will 1000 yards of cloth come to at 2*s.* 3*d.* per yard? 2*s.* 3*d.* are 108 farthings, then £108 + 10*d.* × 108 = £108 + 4*l.* 10*s.* = 112*l.* 10*s. Ans.*

3. What will 1000 yards of tape come to at $1\frac{1}{4}$*d.* per yard, then £5 + 10*d.* × 5 = 5*l.* 4*s.* 2*d. Ans.*

Or, 4*l.* 3*s.* 4*d.* × $1\frac{1}{4}$*d.* = 4*l.* 3*s.* 4*d.* + 1*l.* 0*s.* 10*d.* = 5*l.* 4*s.* 2*d. Ans.* as before.

4. What will 1000 gallons of rum come to at 11*s.* 8*d.* per gallon. First in 11*s.* 8*d.*=140*d.* then 4*l.* 3*s.* 4*d.*×10 ×2×7 (140)=41*l.* 13*s.* 4*d.*×2×7=83*s.* 6*s.* 8*d.*×7= 583*l.* 6*s.* 8*d.* *Ans.*

Or to £560+5600*d.*=£560+23*l.* 6*s.* 8*d.*=583*l.*6*s.*8*d* *Ans.* as before.

7. *Having the Price of* 1000 *to know the Price of* 1.

Rule. Multiply the price per 1000 by 6, and $\frac{1}{25}$ part of the product is the answer in pence.

Examples. 1. Gave 6*l.* 5*s.* for 1000 oranges, what is that for each. Then 6*l.* 5*s.*×6÷25=37*l.* 10*s.*÷25=$1\frac{1}{2}$*d.* each, *Ans.*

2. Gave 5*l.* 4*s.* 2*d.* for 1000 yards of tape, what did it cost a yard? Then 5*l.* 4*s.* 2*d.*×6÷25=31*l.* 5*s.* 0*d.*÷25 =$1\frac{1}{4}$*d.* each, *Ans.*

3. Gave 583*l.* 6*s.* 8*d.* for 1000 gallons of rum, what did it cost per gallon. 583*l.* 6*s.* 8*d.*×6÷25=£3500÷ 25=140*d.*=11*s.* 8*d.* per gallon, *Ans.*

N.B. Or you may multiply the price of 1000 in £.'s by this decimal ,24.

8. *Having the Price of* 1, *to find the Price of a Gross.*

Rule. The price of 1 in pence multiplied by $\frac{3}{5}$ is the answer in pounds.

Examples. 1. At $3\frac{1}{2}$*d.* each, what will a gross come to? Then $3\frac{1}{2}\times\frac{3}{5}=\frac{10\frac{1}{2}}{5}=$ £$2\frac{1}{10}$=2*l.* 2*s.* *Ans.*

2. What will a gross of buttons come to at 3 farthings each? Then $\frac{3}{4}\times\frac{3}{5}=\frac{9}{20}$=9*s.* 0*d.* *Ans.*

3. What will a gross of corks come to at 6 for a penny? Then $1\times\frac{3}{5}\times\frac{1}{6}=\frac{3}{30}=\frac{1}{10}$=2*s.* *Ans.*

9. *Having the Price of a Gross, to find the Price of* 1.

Rule. The third part of a gross in shillings, is the price of one in farthings.

EXAMPLES. 1. At 2*l*. 2*s*. the gross, what is that for 1? First 2*l*. 2*s*.=42*s*. then 42÷3=14 farthings=$3\frac{1}{2}$*d*. *Ans.*

2. At 9*s*. the gross, what is the price of 1? Then 9÷3 =3 farthings, *Ans.*

3. At 3 guineas the gross, what is it for 1? 3 guineas= 63*s*. then 63÷3=21 farthings=$5\frac{1}{4}$*d*. *Ans.*

10. *Having the Price of a Gallon of Liquors, to find the Price of a Tun, Pipe, or Hogshead.*

RULE. Reckon every penny per gallon a guinea, or every shilling 12 guineas, every farthing a quarter guinea; half of which will be the price of a pipe, a fourth part that of a hogshead.

EXAMPLES. 1. Brandy at 16*s*. 6*d* per gallon, how much per tun, per pipe, and hogshead?

First in 16*s*. 6*d*.=198*d*. then 198 guineas=207*l*. 18*s*. price per tun, and 207*l*. 18*s*.÷2=103*l*. 19*s*. per pipe, and 51*l*. 19*s*. 6*d*. per hogshead, *Ans.*

2. Oil at 4*s*. 6*d*. per gallon, what is that per tun,pipe, and the hogshead? First 4*s*. 6*d*.=54*d*. then 54 guineas= 56*l*. 14*s*. per tun, 28*l*. 7*s*. per pipe, and 14*l*. 3*s*. 6*d*. per hogshead, *Ans.*

3. Jamaica rum at 12*s*. 6*d*. per gallon, how much a tun, pipe, and per hogshead?

First in 12*s*. 6*d*.=150*d*. then 150 guineas=157*l*. 10*s*. per tun, 78*l*. 15*s*. a pipe, 39*l*. 7*s*. 6*d*. per hogshead, *Ans.*

N.B. If the price of a tun is given, reckon a penny a gallon for every guinea, half a guinea for a pipe, a quarter guinea for every hogshead.

11. *Having the Price of a Chaldron of Coals, to find that of a Bushel, and the contrary.*

RULE 1. For every 3*s*. in the chaldron reckon a penny, to which add a farthing for every 9*d*. gives the price per bushel in pence.

2. And three times the number of pence in the bushel is the price for a chaldron in shillings.

EXAMPLES. 1. How much per bushel is 51*s.* 9*d.* a chaldron? First $51 \div 3 = 17$ and a $\frac{3}{4}$ for 9*d.* gives $17\frac{3}{4}$*d.* per bushel.

2. How much per bushel is 58*s.* 6*d.* a chaldron? $58\frac{1}{2} \div 3 = 19\frac{1}{2}$*d.* per bushel, *Ans.*

3. How much per chaldron is $14\frac{1}{2}$*d.* per bushel? Then $14\frac{1}{2} \times 3 = 43\frac{1}{2}$*s.* = 2*l.* 3*s.* 6*d.* the chaldron, *Ans.*

4. How much a chaldron is $22\frac{1}{2}$*d.* per bushel? Then $22\frac{1}{2} \times 3 = 67\frac{1}{2}$*s.* = 3*l.* 7*s.* 6*d.* the chaldron, *Ans.*

12. *Having the Price of a Grain, to find the Price of an Ounce, and also of a Pound.*

RULE 1. Double the pence in the price, gives the price of an ounce in pounds.

2. Multiply the farthings in the price by 6, gives the price of a pound in pounds sterling.

EXAMPLES. 1. At $2\frac{1}{4}$*d.* a grain, how much for an ounce? Then $2\frac{1}{4} \times 2 =$ £$4\frac{1}{2}$ = 4*l.* 10*s.* *Ans.*

2. At $1\frac{3}{4}$*d.* a grain, how much for a pound? $1\frac{3}{4}$*d.* × 6 = 7 farthings × 6 = £42, *Ans.*

13. *Having the Price of a Pennyweight, to find that of a Pound.*

RULE. The pence in the pennyweight is the answer in pounds.

EXAMPLE. At $11\frac{1}{2}$*d.* the pennyweight, how much per pound? Then $11\frac{1}{2}$ = 11*l.* 10*s.* 0*d.* *Ans.*

14. *Having the Price of a Stone, or 14lbs., to find the Price of a Ton.*

RULE. Reduce the price into pence, then $\frac{2}{3}$ of that number is the *Ans.* in pounds.

EXAMPLES. 1. At 3*s.* 10*d.* the stone, what is that a ton? First 3*s.* 10*d.* = 46*d.* then $46 \times \frac{2}{3} = \frac{92}{3}$ = £$30\frac{2}{3}$ = 30*l.* 13*s.* 4*d.* *Ans.*

2. At 4*s.* $9\frac{1}{2}$*d.* the stone, what is that at the ton? First 4*s.* $9\frac{1}{2}$*d.* $=57\frac{1}{2}$*d.* then $57\frac{1}{2}d. \times \frac{2}{3} = \frac{115}{3} = £38\frac{1}{3} =$ 38*l.* 6*s.* 8*d.* *Ans.*

N.B. Eight times the price of a stone is the price per cwt.

15. *Having your weekly Expenses, to know what it cost you in the Year.*

Rule. Count as many shillings and as many pence as there are farthings in the week's expense, to the sum add one day's expense.

Examples. 1. At 1*l.* 3*s.* 6*d* per week, what is that per year? First 1*l.* 3*s.* 6*d* $=$ 282*d.* $=$ 1128 farthings, then 1128 shillings $+$ 1128*d.* $+$ $40\frac{1}{2}$*d.* $=$ 56*l.* 8*s.* $+$ 4*l.* 14*s.* $+$ 3*s.* $4\frac{1}{2}$*d.* $=$ 61*l.* 5*s.* $4\frac{1}{2}$*d.* *Ans.*

2. At 2 guineas per week, how much per year? First 42*s.* $=$ 504*d.* $=$ 2016 farthings, then 2016*s.* $+$ 2016*d.* $+$ 6*s.* $=$ 2190*s.* $=$ 109*l.* 10*s.* 0*d.* *Ans.*

3. At 18*s.* per week, how much in the year? First 18*s.* $=$ 216*d.* $=$ 864 farthings, then 864*s.* $+$ 864*d.* $+$ 2*s.* $6\frac{6}{7}$*d.* $=$ 43*l.* 4*s.* $+$ 3*l.* 12*s.* $+$ 2*s.* $6\frac{3}{4}$*d.* $=$ 46*l.* 18*s.* $6\frac{3}{4}$*d.* *Ans.*

16. *Having the Expenses of one Day, to find how much it is for a Year.*

Rule. Reckon every penny per day, 1*l.* 10*s.* 5*d.* per year.

Examples. 1. At 17*d.* per day, how much in the year? 1*l.* 10*s.* 5*d.* $\times$ 17 $=$ 6*l.* 1*s.* 8*d.* $\times$ 4 $+$ 1 $=$ 24*l.* 6*s.* 8*d.* $+$ 1*l.* 10*s.* 5*d.* $=$ 25*l.* 17*s.* 1*d.* *Ans.*

Or set it down thus, 17*l.* $+$ 8*l.* 10*s.* $+ \overline{17 \times 5d.} = £25.$ 10*s.* $+$ 7*s.* 1*d.* $=$ 25*l.* 17*s.* 1*d.* as before.

2. At 3*s.* 6*d.* per day, how much for a year? 1*l.* 10*s.* 5*d.* $\times$ 42 $=$ 9*l.* 2*s.* 6*d.* $\times$ 7 $=$ 63*l.* 17*s.* 6*d.* a year, *Ans.*

Or £42 $+$ £21 $+$ 210*d.* $=$ 63*l.* 17*s.* 6*d.* *Ans.* as before.

3. At 7*s.* $9\frac{1}{2}$*d.* per day, how much for a year? First 7*s.* $9\frac{1}{2}$*d.* $=$ $93\frac{1}{2}$*d.* then 93*l.* 10*s.* $+$ £46. 15*s.* $\times$ $467\frac{1}{2}$*d.* $=$ 140*l.* 5*s.* $+$ 1*l.* 18*s.* $11\frac{1}{2}$*d.* $=$ 142*l.* 3*s.* $11\frac{1}{2}$*d.* a year, *Ans.*

17. *Having your yearly Income, to find what it is a D*[illegible]

Rule. Take the third part of your yearly income in pounds, and double it, gives you your daily income in pence.

Examples. 1. If a servant's wages is 20 guineas a year, how much is that per day? 20 guineas $\div 3 =$ £$21 \div 3 = 7$, then $7 + 7 = 14d.$ a day, *Ans.*

2. At £50 a year, how much is it a day? Then £$50 \div 3 = 16\frac{2}{3}$. $16\frac{2}{3} \times 2 = 33\frac{1}{3}d.$ or 2*s.* 9*d.* a day nearly, *Ans.*

3. At £60 a year, how much per day? $60 \div 3 = 20$. $20 \times 2 = 40d.$ or 3*s.* 4*d.* a day nearly, *Ans.*

4. At £80 a year, how much per day? $80 \div 3 = 26\frac{2}{3}$, then $53\frac{1}{3}d. = 4s.\ 5d.$ nearly, *Ans.*

THE END.

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